VOLUME 52 NUMBER 2

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UNCORRECTED HEARING DEFECTS MAY CAUSE PHYSICAL AILMENTS

Partly heard sentences, incompletely heard words—no one with normal hearing can possibly understand the minute-by-minute, the hour-by-hour effort put forth by the hard-of-hearing who live tensely in a hearing world. It is much like listening to a short wave broadcast under poor atmospheric conditions. Some words come through, others are indistinct sounds, while others are lost entirely.

Such an experience no one would willingly repeat. Yet it is the fate of those with hearing defects to live in such a nerve-wracking world. Small wonder, then, that fatigue and irritability so often overwhelm the hard-of-hearing; for them to live in the hearing world "involves an expenditure of energy far beyond that of the normal person," and "daily exhaustion" is often the price paid.[1]

Undoubtedly this fatigue adds to susceptibility to many common diseases. "A general tendency toward respiratory ailments" was found in one group of hard-of-hearing children.[2] Those who used hearing aids regularly appeared to be in better health, to have fewer illnesses than those who did not wear them.[2]

NOISES FROM WITHIN THE BODY ARE MORE ANNOYING THAN THOSE FROM WITHOUT

Adding to the irritation and fatigue is the presence, in the hard-of-hearing, of persistent and usually constant tinnitus.[3] The inner ear is conditioned to shut out noises from the environment.[3] The honking of automobile horns, the sound of feet on the pavement, the cry of the neighbor's baby—the hearing person can cut these off from consciousness. Tinnitus is more demanding of attention, more annoying, perhaps because one cannot walk away from a noise within oneself.

Yet the situation can be ameliorated. The use of mechanical aids to improve the hearing actually relieves the tinnitus as well. It is masked by the amplification of outside sound reaching the cochlea.[3] Concentration on sounds outside the body suppresses the consciousness of internal head noises. The noises are still there, but one is not so conscious of them.

IMAGINATION WORKS OVERTIME IN THE DEAF

Even a person with normal hearing may believe, at times, that others are talking about him. And rare is he who believes such remarks are complimentary! It is easy to understand why the hard-of-hearing become suspicious. They are no part of the world they see around them. People are talking, but about what? The hard-of-hearing can only guess, from the snatches of sentences they hear, the nature of the conversation. Their imagination thrives in their isolation.

Common emotional disturbances of those with loss of hearing are depression, hysteria, tendency toward hypochondriasis and psychasthenia.[4] Nervous or mental illness—commonly manifested as depression, anxiety and tension—was present in 31.3 per cent of a group of 1100 defective hearing persons at Borden General Hospital.[5]

Though it is true that "a person secure in his own emotional life will develop no paranoid trends even when deafened,"[6] it is also true that "the frequency of such paranoid trends shows . . . how many persons feel insecure in their social relations. Deafness may not be the fundamental cause of the trends, but it waters the seeds and encourages them to grow."[6]

One must indeed be emotionally stable to withstand the strains to which the hard-of-hearing person is subjected daily and hourly. Much, however, can be done to help such a patient. His depression may be relieved when he understands—as he may not have done—how much he misses the background of sound which is a pattern to normal daily living.[6] Depression, too, may be due to an unfulfilled aesthetic need for music. Music from the piano or from the babbling brook alike lift the soul. A hearing aid may help the situation, "even when it only serves to couple the individual to a world of sound patterns."[6] The stimulation of the vibratory sense in the totally deaf has definite psychological value.

Every assistance that modern science has devised should be made available to those with hearing defects, so that physical disorders and emotional disturbances be relieved in those who already, by reason of their handicap, find normal living difficult.

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[1]Cooke, R. A.: *Allergy in Theory and Practice*, Philadelphia: W. B. Saunders Company, 1947, p. 186

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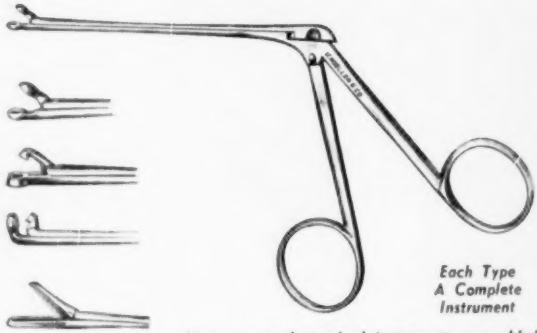

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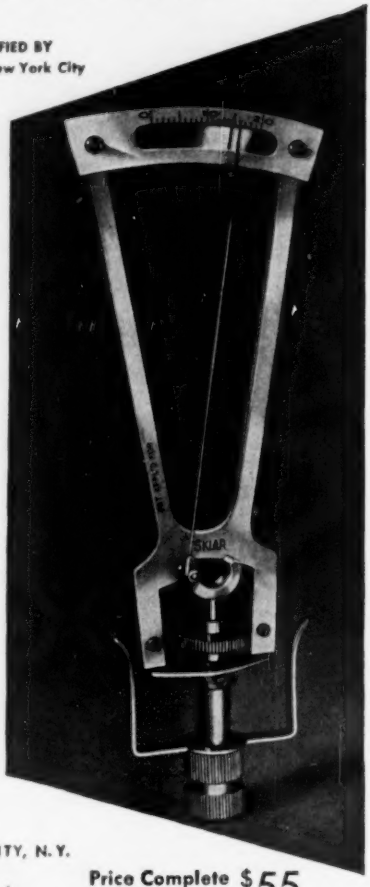

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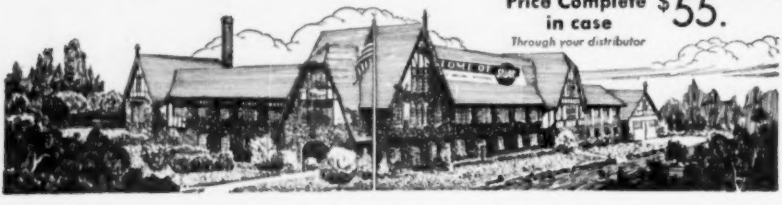

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TEN YEAR STUDY OF FRONTAL SINUSITIS AT THE LOS ANGELES COUNTY GENERAL HOSPITAL

FORDYCE JOHNSON, M.D.

PASADENA, CALIF.

A STUDY of frontal sinusitis, acute and chronic, was undertaken to show the trend of this disease for the past ten years, including a compilation of the various factors relevant to this disease.

A secondary observation has been the effect of penicillin in the treatment of frontal sinusitis.

A thorough screening of the literature for a similar report was made without results.

This study covers the ten year period from 1938 to June 1948. During this period there were 297 cases of infection of the frontal sinus listed in the files of the record room of the Los Angeles County General Hospital. A close scrutiny of these cases indicated that 143 met the necessary requirements for inclusion in this study on the basis of clinical and roentgenographic findings, operation, etc. Of the 297

TABLE 1.—*Case Charts of Frontal Sinusitis*

	Number	Per Cent
Charts of diagnosed frontal sinusitis	143	48
Charts not in files	26 }	52
Charts of unconfirmed frontal sinusitis	128 }	
Total	297	100

cases, 26 charts could not be located, and in 128 the diagnosis included frontal sinusitis as a differential diagnosis which was not substantiated by the patient's condition at the time of discharge from the hospital or by findings on autopsy. In these cases were included such conditions as psychoneurosis, menopausal disturbances, cardiac failure, diabetes mellitus, pneumonia, influenza, chickenpox, cancer of the stomach, maxillary and ethmoid sinusitis, allergies, headaches due to mastoiditis, deviation of the nasal septum, acute alcoholism and brain abscess.

From the Department of Otolaryngology, University of Southern California Medical College, Los Angeles, service of Dr. J. MacKenzie Brown.

Candidate's thesis presented in partial fulfilment of the requirements for membership in the American Laryngological, Rhinological and Otological Society, Inc.

The practical interpretation of an acute and of a chronic state of frontal sinusitis should be made on a pathologic basis, in which an acute frontal sinusitis is diagnosed by the presence of an acute inflammatory infiltration of the sinus lining, segmented granulocytes and edema. A chronic frontal sinusitis is diagnosed by the presence of plasmacytes (plasma cells), with areas of fibrosis and interstitial edema of the mucous membrane.

Since only clinical findings were available on the charts studied, a less accurate and empiric basis was adopted. Also, to prevent further inaccuracies, an intermediate diagnosis of subacute frontal sinusitis was not used.

TABLE 2.—*Classification of Total Series of Patients by Sex*

	Number	Per Cent
Males	94	65.7
Females	49	34.3
Total	143	100

TABLE 3.—*Analysis of Cases of Acute and Chronic Frontal Sinusitis According to Sex*

	Number	Per Cent	Per Cent of Total (143)
Acute Frontal Sinusitis			
Males	84	67	59
Females	41	33	29
Total	125	100	88
Chronic Frontal Sinusitis			
Males	10	55	7
Females	8	45	5
Total	18	100	12

In this report acute frontal sinusitis is understood to represent an acute infection of a frontal sinus of thirty days' duration or less, a chronic infection to be over thirty days in duration. It is conceded that a patient may have had a chronic infection with an acute episode superimposed.

In a breakdown of the cases studied the following information was obtained. Of the 143 patients, 94 were males, representing 65.7 per cent of the patients, and 49 were females, representing 34.3 per cent of the patients. Of the 125 patients with acute frontal sinusitis, 84, 67 per cent, were males and 41, 33 per cent, were females. Of the 18 patients with chronic frontal sinusitis, 10, 55 per cent, were males and 8, 45 per cent, were females. Of the 24 patients with acute frontal sinusitis with a chronic background, 19, 79 per cent, were males and 5, 21 per cent, were females.

The incidence of frontal sinusitis in Los Angeles County Hospital according to race—white, Mexican and Negro—was studied in this area and its relation to the population determined. There has been an increase in population from 1938 to 1948. The only analysis based on race segregation made by the Bureau of Vital Statistics of Los Angeles County during this ten year period was in 1940.

TABLE 4.—*Population of Los Angeles County*

Year	Number
1938	2,730,900
1940	2,785,643
1948	4,129,592

TABLE 5.—*Population of Los Angeles County in 1940 by Race*

Race	Number	Per Cent of Total
White	2,660,042	95.5
Mexican (and others)	75,209	2.7
Negro	50,392	1.8
Total	2,785,643	100

TABLE 6.—*Classification of Patients at Los Angeles County General Hospital According to Race*

Race	1940		1948	
	Number	Per Cent	Number	Per Cent
White	40,705	69	39,564	53
Mexican	12,525	21	16,726	22
Negro	5,624	9	18,315	24
Others	574	1	734	1
Total	59,428	100	75,339	100

The classification according to race of the patients of the Los Angeles County General Hospital was first available in 1940. It is as follows: white patients, 40,705, or 69 per cent; Mexican, 12,525, or 21 per cent; Negro, 5,624, or 9 per cent, and others, 574, or 1 per cent of the total, 59,428 patients. A similar breakdown for 1948 shows a racial shift as follows: white patients, 39,564, or 53 per cent; Mexican patients, 16,726, or 22 per cent; Negro patients, 18,315, or 24 per cent, and others, 734, or 1 per cent of the total, 75,339 patients.

From this classification it can be noted that the racial load in the hospital for Mexicans and Negroes is greater than the population per-

centage for the county as a whole. The clinic load of the Los Angeles County General Hospital shows a comparable breakdown for races, as has been shown for the hospital according to the assistant registrar of the hospital. The clinic load for the ear, nose and throat clinic and the total for all clinics, including the ear, nose and throat clinic, for the years from 1938 to 1948 are indicated in table 7.

The attendance at all clinics at Los Angeles County General Hospital for the ten year period of 1938 to 1948 was 2,506,645 patient visits; the admissions to the hospital, which are included in this figure

TABLE 7.—*Outpatient Visits to Clinics of Los Angeles County General Hospital*

Fiscal Year	Ear, Nose and Throat Clinic	Total All Clinics
1938-39	17,225	351,747
1939-40	14,591	330,211
1940-41	16,170	333,448
1941-42	12,928	274,043
1942-43	7,133	188,821
1943-44	6,384	165,879
1944-45	7,137	167,381
1945-46	6,291	190,071
1946-47	7,517	227,701
1947-48	9,594	277,343
Total	104,880	2,506,645

TABLE 8.—*Patient Load at Los Angeles County General Hospital from 1938 to 1948*

Clinic visits (all clinics)	2,506,645
Ear, nose and throat clinic visits	104,880
Hospital admissions	597,034
Cases of frontal sinusitis (hospital admissions)	143

for the same period, were 597,034. The attendance at the ear, nose and throat clinic for the period between 1938 and 1948 was 104,880 patient visits. There were 143 cases of frontal sinusitis obtained from the hospital records.

It would be inaccurate to confuse patient visits with patient admissions to the hospital, but an estimate of the ratio of frontal sinusitis to general illness and those affecting the ear, nose and throat may be obtained from these figures.

A similar breakdown in this report based on the total number of patients with acute and with chronic frontal sinusitis by race indicates that there were 108 white patients, 76 per cent of the total; 18 Mexican patients, 12 per cent of the total, and 17 Negro patients, 12 per cent of the total, 143.

A further breakdown of the cases by race as to chronicity and sex, in which the total number again is 143, shows nearly an equal number of Mexican male and female patients among those with acute frontal sinusitis, that is, 6 and 7 respectively, while the ratio of male to female among the white and Negro patients is about 2 to 1. The ratio becomes slightly greater among those with chronic frontal sinusitis,

TABLE 9.—*Classification of Patients with Acute and Chronic Frontal Sinusitis by Race*

	White	Mexican	Negro	Total
Number	108	18	17	143
Percentage of total	76	12	12	100

TABLE 10.—*Chronicity of Frontal Sinusitis According to Race*

Race	Acute Condition		Chronic Condition		Total
	Males	Females	Males	Females	
White	68	29	8	3	108
Mexican	6	7	0	5	18
Negro	10	5	2	0	17
Total	84	41	10	8	143

TABLE 11.—*Total Number of Patients by Race and Chronicity*

Race	Number with the Acute Condition	Number with the Chronic Condition	Ratio	Total
White	97	11	9 to 1	108
Mexican	13	5	2½ to 1	18
Negro	15	2	7 to 1	17

with white persons having a ratio of 8 to 3, and Negroes, 2 to 0 for male and female patients.

A further differential by race as to chronicity shows that the ratio for white persons is about 9 with the acute condition to 1 with the chronic; for Negro patients about 7 with the acute to 1 with the chronic condition, and for Mexican patients, nearly 3 to 1.

The age incidence shows several interesting observations. The youngest patient in the 143 charted, including all types of frontal sinusitis, was 9 years, the oldest, 75 years. The greatest incidence was at 25 years of age, with lesser peaks at 13 and 33 years.

TABLE 12.—*Classification of Patients by Age*

Age	Number	Age	Number	Age	Number
9	1	27	4	44	2
11	2	28	2	46	1
12	3	29	3	47	2
13	7	30	3	48	1
14	6	31	3	49	1
15	4	32	3	50	1
16	5	33	8	53	1
17	5	34	3	54	1
18	5	35	1	55	1
19	2	36	2	60	3
20	2	37	2	61	3
21	6	38	1	64	1
22	3	39	1	67	2
23	7	40	1	68	1
24	7	41	2	70	1
25	10	42	2	72	1
26	4	43	2	75	1

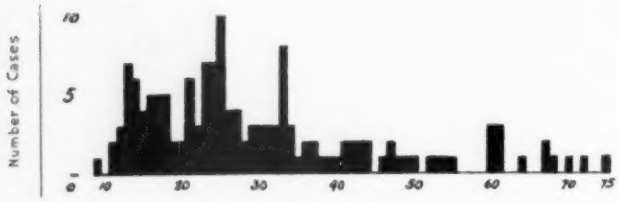

Chart 1.—Age incidence by years.

In the Los Angeles area there has been a seasonal variation which is probably prevalent in other parts of the country also. The incidence of cases of frontal sinusitis shows a definite peak period during the winter months of February and March, with a lesser peak during July and

TABLE 13.—*Incidence of Frontal Sinusitis by Years*

Year	First Half	Second Half	Total
1938	10	6	16
1939	8	4	12
1940	8	13	21
1941	7	9	16
1942	5	4	9
1943	8	3	11
1944	6	4	10
1945	8	8	16
1946	4	5	9
1947	6	9	13
1948	10	not reported	10
Total	76	67	143

August. The peak of the winter season was definite in eight out of ten years, and in the other two years the peak was in January.

The predisposing cause for frontal sinusitis is predominately a head cold. Of 143 cases, a history of head cold was given as a causal factor in 103, or 72 per cent. The duration of the cold was from two days to more than a month prior to the patient's admission to the hospital.

There were 13 cases in which the contributing cause was not determinable from the available history. In the majority of cases this was due to the patient's poor condition at time of admission to the hospital.

There were 12 cases in which swimming was given as a cause of the frontal sinusitis. There were several cases in which swimming was

TABLE 14.—*Head Cold as Causal Factor*

Duration of Symptoms Prior to Admission By Days	Number of Cases
2	1
3	3
4	2
5	8
6	2
7	24
8	3
9	1
10	13
11	0
12	2
13	0
14	25
21	6
31	15
Total Cases	103

followed by a head cold in one to three days. It is interesting to observe that in the 12 cases here reported, the condition in 7 was serious, with 2 fatalities.

There were 4 cases of tumor involving the frontal sinuses: 1 squamous cell carcinoma, grade 2; 1 giant cell tumor; 1 osteoma, and 1 cancer, type and grade not specified.

Three cases of mucocele are included in this report. In each case a history of previous operation was given. The operation had been performed twelve, seventeen and thirty years prior to this hospitalization.

The contributing condition in 8 cases was pneumonia (1), trauma (2), chickenpox (1), diphtheria (1), rheumatic fever (1), dental extraction (1) and allergy (1). Indirectly, if not directly, all these contributing factors may be conceded as primary factors without which the sinusitis would not have developed.

In cases of both acute and chronic frontal sinusitis the right frontal sinus was affected in 53; the left frontal sinus in 70, and both the right and the left in 20. On a percentage basis, the right frontal sinus was

TABLE 15.—*Predisposing Causes and Related Conditions of Frontal Sinusitis*

Acute Frontal Sinusitis	103
Head cold	13
Unknown causes	12
Swimming	8
Miscellaneous	
Related Conditions	4
Tumor	3
Mucocele	
Total number	143

TABLE 16.—*Frontal Sinus Involved*

	Right	Left	Bilateral	Total
Number of cases	53	70	20	143
Percentage of cases	37	49	14	100

TABLE 17.—*Duration of Symptoms in Acute Frontal Sinusitis*

Days After Onset	Number of Cases
	11
1	11
2	27
3	8
4	15
5	12
6	15
7	1
8	1
9	10
10	0
11	0
12	0
13	6
14	3
21	5
30	
Total	125

involved in 37 per cent of the cases; the left in 49 per cent, and both the right and the left in 14 per cent.

Not much time elapsed from the onset of symptoms to the patient's admission to the Los Angeles County General Hospital, for it was shown that a high percentage of patients entered the hospital early in the course of the disease. The greatest number, nearly one half of the patients with acute symptoms, were admitted in the first three days.

TABLE 18.—*Duration of Symptoms in Chronic Frontal Sinusitis*

	Number of Cases
Months	
2 to 8	3
Years	
1	1
2	4
3	3
4	0
5	3
10	4
Total	18

An attempt was made to show the incidence of morbidity and mortality between acute and chronic cases, but it was not possible, for in

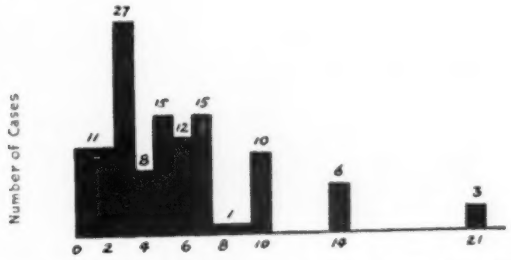

Chart 2.—Duration of symptoms by days when the patient was first seen at the hospital.

these cases such variable results were shown, dependent on so many factors, that to attempt to prognosticate was not considered feasible.

The mortality rate in cases of frontal sinusitis indicated some very interesting observations. Of the 143 patients, 111 or 77 per cent, were seen in the ear, nose and throat service. The remainder, 32, or 23 per cent, were seen in other services, as shown in table 19.

TABLE 19.—*Services in Which Patients with Frontal Sinusitis Were Seen*

Service	Number
Ear, nose and throat	111
Contagious diseases	10
Surgical	3
Neurologic	11
Medical	7
Pediatric	1
Total	143

Consultations between services were requested for 8 of the 32 patients (25 per cent) seen in the ear, nose and throat service prior to discharge or death.

The ear, nose and throat service with 111 patients had 11 deaths, a mortality rate of 10 per cent. The contagious disease service with 10 patients had 6 deaths, a rate of 60 per cent. The surgery service with 3 cases of tumor had 1 death (a case of cancer of the left frontal sinus in a man aged 75), a rate of 33.3 per cent. The neurologic service

TABLE 20.—*Outcome by Services in Cases of Frontal Sinusitis*

Service	Recoveries	Deaths	Total
Ear, nose and throat	100	11	111
Contagious diseases	4	6	10
Surgical	2	1	3
Neurologic	2	9	11
Medical	5	2	7
Pediatric	0	1	1
Total	113	30*	143

* Autopsies were obtained in 25 of the 30 cases and refused in 5.

TABLE 21.—*Deaths in the Various Services by Years*

Year	Ear, Nose and Throat	Contagious Diseases	Neurologic	Medical	Surgery	Pediatrics	Total
1939	1	0	2	1	0	0	4
1940	5	0	0	0	0	0	5
1941	1	0	4	0	0	0	5
1942	0	1	1	0	0	0	2
1943	0	2	2	1	0	1	6
1944	1	2	0	0	0	0	3
1945	1	0	0	0	0	0	1
1946	1	0	0	0	0	0	1
1947	0	1	0	0	0	0	1
1948*	1	0	0	0	1	0	2
Total	11	6	9	2	1	1	30

* Deaths in 1948 include 1 case of squamous cell carcinoma, grade 2, involving the left frontal sinus in a patient aged 75 treated in the tumor clinic, a branch of the surgical service.

with 11 patients had 9 deaths, a rate of 82 per cent; the medical with 7 patients had 2 deaths, a rate of 29 per cent, and the pediatric with 1 patient had 1 death, a rate of 100 per cent. Several qualifying statements should be made in explanation of these figures. The great percentage of deaths in all services occurred prior to 1944. Many of the patients died soon after admission (72 hours), so that there was little time to transfer a patient from one service to another, and had operation been performed the prognosis would not have been greatly altered. However, early relief from pressure in acute frontal sinusitis does save lives.

There was a definitely higher mortality rate during the years from 1938 to 1944, with a drop in deaths from 1945 through June 1948. The use of penicillin, which was made available in 1944 and was increasingly used in 1946 to 1948, undoubtedly was an important factor in lowering the mortality rate during the latter period. Credit should be given to the services for cooperating by seeing that adequate and prompt consultations were obtained in indicated cases. The use of both the ear, nose and throat and the neurologic service in the more serious cases is desirable.

There were 3 cases of mucocele in the 143 cases of frontal sinusitis. The dominant factor found as a predisposing cause in these 3 cases was previous operation. Radical surgery had been done thirty years, seventeen years and twelve years before admission respectively. Previous operation and anatomic anomalies contributing toward blockage of the nasofrontal duct have, in my experience, been the dominant factors in the formation of a mucocele. In the first and second of these 3 cases

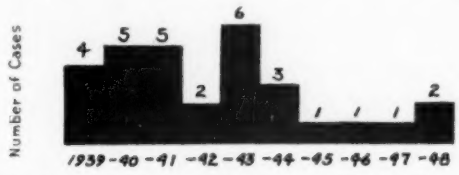

Chart 3.—Deaths from frontal sinusitis by years. (See footnote to table 21.)

treatment had been instituted in 1940 and in the third in 1947. At the latter date a tantalum tubing was used with success, after the technic of Goodale.[1] The structure of the tantalum tube was improved by Harris [2] in 1948. Goodyear [3] advocated a gold tube following radical surgery on the frontal sinus but expressed the belief that mucoceles in a large majority of cases can be approached by the intranasal route.

A discussion of mucoceles by Brunner and Savitt [4] stressed the importance of operation as a causative factor. They stated that the Jansen-Lynch or Killian type of radical frontal surgery has a greater

1. Goodale, R. L.: The Use of Tantalum in Radical Frontal Sinus Surgery, Ann. Otol., Rhin. & Laryng. **54**:757-762 (Dec.) 1945.

2. Harris, H. E.: The Use of Tantalum Tubes in Frontal Sinus Surgery, Cleveland Clin. Quart. **15**:129-133 (July) 1948.

3. Goodyear, H. M.: Surgery of the Frontal Sinus, Laryngoscope **57**:340-353 (May) 1947.

4. Brunner, H., and Savitt, L.: Mucocele of Frontal and Orbital Cells, Ann. Otol., Rhin. & Laryng. **56**:917-926 (Dec.) 1947.

incidence than other types. A report by Stewart [5] failed to mention previous operation as a causative factor. He did list trauma, but he implied that fracture in the region of the nasofrontal duct is the dominant cause. The presence of previous infection at the time of operation is important; however, infection alone without extensive surgical procedure seems unlikely as a cause for this condition.

Other contributing factors [6] may also be present: anatomic anomalies, including deviation of the nasal septum with pressure; blockage of the nasofrontal duct; narrowing of the nasofrontal duct owing to congenital anomalies; curvature with impingement of its lumen, and pressure from an adjacent ethmoid or frontal ethmoid cell decreasing its lumen.

The presence of a mucocele plus bacteria transfers an otherwise quiescent pathologic process to a more active pathologic process and hastens a surgical procedure.

The causal factors of mucocele are indicated in the following tabulation.

1. Operation
   - Radical
   - Simple
   - (with damage or destruction of nasofrontal duct)
2. Anatomic anomalies
   - Narrowing of nasafrontal duct
     - Congenital anomaly
     - Curvature of nasofrontal duct
     - Enlargement of adjacent ethmoid or frontal ethmoid cell
   - Deviation of nasal septum
3. Trauma
   - From injury
   - From operation

There were 12 cases in which swimming was stated as the etiologic factor, and in 2 of these an associated head cold was said to have followed swimming in twenty-four and seventy-two hours respectively. The 12 cases represent 8 per cent of the 143 cases. Of greater significance, however, are the complications which appeared in the 12 cases. In 5 cases recovery followed local treatment. In 5 cases trephination of the frontal sinus was required, in 1, bilaterally; in 1 the condition was complicated by osteomyelitis and in 1, by a subdural abscess. There were 2 deaths, with the diagnosis of frontal sinusitis confirmed by autopsy. In 1 of these 2 cases death occurred eight hours after the patient's admission to the hospital; the second death occurred thirteen days after

5. Stewart, E. F.: Mucocele of the Frontal Sinus, J. Laryng. & Otol. **63**:70-78 (Feb.) 1949.

6. Brown, J. M.: Personal communication to the author.

admission, in the contagious disease service; there had been no consultation and no operation.

The question has been raised whether or not swimming is a cause of frontal sinusitis. There may be a doubt about this assumption, as raised by Hitschler.[7] However, it does seem probable that swimming is a very important contributing factor. In 1 of the cases reported, symptoms of an acute frontal sinusitis developed within twenty-four hours after swimming. Swimming will have to be considered a con-

TABLE 22.—*Cases of Frontal Sinusitis Following Swimming*

Termination	Number
Local treatment and recovery	5
Trephination	
One side	2
Bilateral	1
Subdural abscess	1
Osteomyelitis	1
Death (diagnosed by autopsy)	2

	Contributing Factors			
Case Number	Swimming (Days Before Admission)	Duration of Hospitalization	Trephination	Complication
1	14	42 days	+	Subdural abscess
2	14	8 hr.	—	Subdural abscess and death
3	21	13 days	—	Pyogenic meningitis and death
4	5	97 days	+	Osteomyelitis
5	5	5 days	—	.....
6	14	19 days	+	(Right and left)
7	4	24 days	+	.....
8	8	35 days	+	.....
9	10	6 days	—	.....
10	7	4 days	—	.....
11	5	5 days	—	.....
12	6	7 days	—	.....

tributing factor since in the list of 12 cases, in 7, or 58 per cent, there were serious complications with 2 deaths, while in 5, or 42 per cent, recovery followed local treatment.

Of the 143 cases there were 18 cases of osteomyelitis, representing 13 per cent of the cases reported. Osteomyelitis was diagnosed by autopsy in 7 cases, by operation in 10 and by roentgenograms in 1. There were 9 deaths. In 2 of the surgical cases terminated by death due to osteomyelitis, permission for an autopsy was refused.

7. Hitschler, W. J.: The Relationship of Swimming and Diving to Sinusitis and Hearing Loss, Laryngoscope **59**:799-822 (July) 1948.

One patient, for whom the diagnosis was made by roentgenograms, presented all the clinical signs and symptoms and roentgenologic evidence; however, he refused surgical procedure and left the hospital against consent. He was later readmitted and treated with penicillin; there were no subsequent complaints referable to the frontal sinusitis. Similar results were reported by Arbuckle [8] in early osteomyelitis before formation of abscess.

A similar report by Johnson [9] showed a smaller number of cases of osteomyelitis over an earlier ten year period (1935 to 1945).

The use of penicillin as a therapeutic agent to lessen the mortality rate was reported by McKenzie.[10] He reported 1 case with recovery by the use of penicillin and gave several references of similar experience. A later report by Glass [11] presented similar findings.

The number of patients requiring various types of operation totaled 70; the number of surgical procedures were 83. Some patients had several surgical procedures carried out at successive times. There were

TABLE 23.—*Cases of Osteomyelitis*

Method of Diagnosis	Number of Cases
Autopsy	7
Operation	10
Roentgenogram	1
Total	18

21 antral irrigations and 5 irrigations of the frontal sinus; 44 trephinations of the frontal sinus, including 4 bilateral trephinations; 7 radical procedures on the frontal sinus; 3 operations for mucocele, and 3 craniotomies. The craniotomies were done in cases of frontal sinusitis by the neurosurgical service. These patients had not been seen by the ear, nose and throat service, and the presence of the frontal sinusitis was determined by autopsy.

There were 14 deaths among surgical patients; the remaining 16 deaths occurred in patients not treated surgically. The ear, nose and throat service treated 11 of the 14 patients, 9 receiving trephination of

8. Arbuckle, M. F.: Treatment of Infection of the Frontal Sinus and Its Complications, Illinois M. J. **95**:27-32 (Jan.) 1949.

9. Johnson, E. D.: Acute Frontal Sinusitis, Arch. Otolaryng. **47**:165-176 (Feb.) 1948.

10. McKenzie, W.: A Case of Osteomyelitis of the Frontal Bone Treated by Penicillin, J. Laryng. & Otol. **62**:33-35 (Jan.) 1948.

11. Glass, G.: A Case of Osteomyelitis of Frontal Bone Following Acute Frontal Sinusitis, Treated by Surgery and Penicillin, J. Laryng. & Otol. **62**:310-313 (May) 1948.

the frontal sinus and 2, radical frontal surgery. The remaining 3 patients were treated by the neurosurgical service, receiving craniotomies and no operation on the frontal sinus.

A further breakdown of the 11 deaths in the ear, nose and throat service indicates that the 9 deaths following trephination were due to meningitis in 3 cases, in 1 of which a metastatic abscess occurred on the left cerebellar hemisphere; an abscess of the frontal lobe in 4, and subdural abscesses in 2. The 2 patients undergoing radical frontal surgery died as a result of extensive osteomyelitis.

The deaths in the ear, nose and throat service occurred mostly in 1940, when 5 of the 11 patients died. The remaining 6 patients died in 1939, 1941, 1944, 1945, 1946 and 1948 respectively.

TABLE 24.—*Surgical Cases*

Region	Trephine	Radical Frontal Procedure	Frontal Irrigation	Antral Puncture	Operation for Mucocele	Craniotomy
Right	19	2	3	8	1	1
Left	21	5	2	5	2	2
Right and left	4	0	0	8	0	0
Total	44	7	5	21	3	3

TABLE 25.—*Deaths Following Surgery in the Ear, Nose and Throat*

Trephination	Total 9 Cases
Meningitis	3 cases
Frontal lobe abscess	4 cases
Subdural abscess	2 cases
Radical Frontal Surgery	Total 2 Cases
Osteomyelitis	2 cases

The duration of the stay in the hospital for the patients recovering with medication and local treatment as compared with that of the patients with complications (such as operation, osteomyelitis and intracranial extension of infection) is shown in table 26.

The average time of hospitalization for the entire ten year period was ten days for the patient with the noncomplicated condition and twenty-eight days for the patient whose condition was complicated. The year 1948 showed a definite decrease for both groups, a greater decrease than in any other similar period.

The interesting observation made from this and preceding tables as to morbidity and mortality is that with penicillin therapy, although one sees as many patients, the period of hospitalization seems to be decreasing and the complications are less, with a definite drop in mortality.

In an attempt to determine whether chronicity was a complication in aggravating a patient's chances of recovery, the following data were compiled. A total of 57 major surgical procedures were performed, including 44 trephines, 7 radical operations on the frontal sinus, 3 operations for mucocele and 3 craniotomies.

The total of acute and chronic cases was 55, 43 acute and 11 chronic. In 2 cases of acute frontal sinusitis several surgical procedures were

TABLE 26.—*Duration of Days in Hospital for Patients with Frontal Sinusitis*

Year	Duration for Patients with Non-complicated Condition	Number	Duration for Patients with Complicated Condition	Number
1948	5½	4	26	5
1947	8	5	22	8
1946	6	5	23	4
1945	6½	5	54 *	8
1944	12	3	17	6
1943	24	4	20	6
1942	14	4	21	3
1941	8	5	37	7
1940	7	7	51	10
1939	10	5	19	6
Average	10		28	

* In 1945 1 patient was hospitalized 215 days, the longest of all in the series. The patient recovered with penicillin therapy from extensive osteomyelitis with sequestrums.

TABLE 27.—*Morbidity and Mortality in Surgical Cases*

	Surgical Cases						Surgical Deaths	
	No Complications		Complications		Total			
Acute	22	52%	21	48%	43	80%	13	30%
Chronic	6	55%	5	45%	11	20%	2	18%
Total	28	53%	26	47%	54	100%	...	....

performed. Only complications of major significance were considered, such as repeated surgical procedures, osteomyelitis and intracranial complications. There was a higher percentage of complication and death among the cases of acute frontal sinusitis.

There were 3 cases in which irrigation of an antrum relieved frontal headache on the same side. Roentgenograms of the sinuses in each instance showed clouding of both frontal and maxillary sinuses. There was no record of a roentgenogram having been made again after the antral irrigation.

The question arises about the extent of involvement of both frontal and maxillary sinuses. Because of the position of the ostiums of the

frontal and maxillary sinuses it is feasible to consider the maxillary sinus the cistern for the frontal sinus and, conversely, the maxillary sinus a source of infection for the frontal sinus. If the pressure is relieved and the pus washed away from the hiatus semilunaris, increased drainage is gained for both frontal and maxillary sinuses.

The question of reliability of a roentgenographic diagnosis of the frontal sinus has been mentioned by Johnson.[9] The absence of roentgenographic findings and the presence of positive pathologic changes were recorded in 13 of the 143 cases studied. Diagnosis in 2 cases was

TABLE 28.—*Summary of Chronic Cases*

Case	Duration of Chronicity	Operation	Complication	Death	Year of Operation
1	10 yr.	Radical frontal	None	—	1942
2	17 yr.	For mucocele	None	—	1940
3	12 yr.	For mucocele	None	—	1947
4	3 yr.	Trephine	Extradural abscess	—	1945
5	3+ yr.	Trephine	Cancer	—	1939
6	8 mo.	Trephine	Frontal lobe abscess	+	1940
7	30 yr.	For mucocele	None	—	1940
8	2 yr.	Radical frontal	None	—	1940
9	6+ mo.	Neurosurgery	Frontal lobe abscess	+	1939
10	2 yr.	Radical frontal	Osteomyelitis	—	1944
11	3 yr.	Radical frontal	None	—	1947

TABLE 29.—*Confirmation of Frontal Sinusitis with Normal Roentgenographic Report*

Source	Autopsy	Radical Frontal Procedure	Trephination	Frontal Irrigation	Clinical Findings	Total
Number	2	1	6	3	1	13

confirmed on autopsy, in 1 by radical frontal surgery, in 6 by trephination, in 3 by irrigation of the frontal sinus and in 1 by clinical findings.

By the same token, a dark antrum in the presence of an acute frontal sinusitis and a normal-appearing frontal sinus on roentgenograms can be misleading, as was shown in 1 case. Here irrigation of the maxillary sinus presented normal findings with no pus, but trephination of the frontal sinus presented pus under pressure.

A discussion of the symptoms, differential diagnosis, diagnosis and prognosis will not be undertaken in this paper.

Treatment of acute frontal sinusitis and chronic frontal sinusitis carried out in a very definite order has proved lifesaving in preventing complications from developing or, if present, in promptly controlling

them. The procedures carried out are those advocated by Brown [12] and are along similar lines presented by Crowe and Lett [13] and Goodyear.[14]

Prior to the advent of penicillin, prompt and adequate operative procedure in all cases was, and still is, indicated. Local treatment is necessary along with operation. The first essential step is creation of an adequate nasal passageway. A 3 per cent ephedrine solution and a 1 per cent cocaine solution, supplied to the patient in separate atomizers, is used in routine cases. The solutions are used as a spray, alternating them every hour, day and night, in very acute cases and increasing the period between applications to every two hours as the patient improves. This procedure is kept up during the patient's stay in the hospital. In the younger patient and the elderly patient a 0.25 per cent solution of phenylephrine hydrochloride (neo-synephrine hydrochloride®) is used in place of ephedrine. In many patients the strict observance of this treatment early and consistently had in thirty-six hours relieved the acute symptoms of frontal headache and early supraorbital swelling and permitted free drainage, with purulent discharge appearing in the middle meatus on the involved side.

Orders included catharsis, determined by the needs of the individual case, forcing of fluids and administration of 2 Gm. of sulfadiazine U. S. P. followed by 1 Gm. every four hours during bed rest. Supportive medication, ½ to 1 grain (0.03 to 0.06 Gm.) of codeine every two to four hours with sedatives, is given to assure adequate rest.

The following additional procedures are to be performed as quickly as feasible. Roentgenograms of the sinuses, including anterior, posterior and lateral views should be made. This procedure is essential in order to learn the size and depth of the frontal sinus, in case operation is contemplated, as well as to learn the extent of infection. (However, absence of roentgenographic findings in the presence of positive clinical findings should be ignored, and the patient's symptoms and signs should guide the surgeon.)

A complete blood count, including white cell count, differential count and sedimentation rate, is extremely valuable. (In one of the cases a temperature of 98.6 to 100 F. with a white blood count of 10,500 and only a slightly elevated differential count, but with a sedimentation rate of 90 mm. in sixty minutes, alerted the surgeon to operate. He found creamy pus under pressure in the right frontal sinus. The patient made an uneventful recovery.)

12. Brown, J. M.: Frontal Sinusitis, Laryngoscope **56**:116-119 (March) 1946.

13. Crowe, S. J., and Lett, J. E.: The Etiology, Treatment and Prevention of Chronic Sinus Infection, Ann. Otol., Rhin. & Laryng. **57**:364-370 (June) 1948.

14. Goodyear, H. M.: Surgery of the Frontal Sinus, Laryngoscope **57**:340-353 (May) 1947.

The presence of an infection in a maxillary sinus should always be suspected, and if it is confirmed roentgenographically an antrum puncture should be done. (Three patients were relieved of frontal headaches by antral irrigations on the same side.)

In known cases of frontal sinusitis, in which the patient's condition warrants it and physical findings permit it, an irrigation of the frontal sinus should be attempted. (Five patients were relieved of acute symptoms by this procedure and were subsequently discharged from the hospital.)

In the more seriously ill patients with the possibility of intracranial complications, a spinal puncture is indicated and should be done. This procedure is important not only for the laboratory findings but for the opportunity of administering penicillin via the intrathecal route.

Patients who are sick with signs of localization of infection to a given frontal sinus, even though early in the course of the disease, are considered candidates for operation, the effectiveness of treatment being the early release from pressure in the involved sinus. The treatment of choice is trephination of the frontal sinus on the side involved. This procedure is done with a general anesthetic; thiopental sodium U. S. P. (pentothal sodium®) administered intravenously is the anesthetic of choice.

The incision is made just below the eyebrow and toward the floor of the frontal sinus. Bleeding is controlled by injection of procaine hydrochloride U. S. P. (novocain®) and epinephrine U. S. P. (adrenalin®) and the use of the Bovie cautery unit. When the sinus floor is reached the periosteum is elevated and an opening made into the sinus by a sharp curet or gouge, and the opening is enlarged by a Kerrison forceps to approximately 0.5 to 1 cm. in diameter. If there is a question of osteomyelitis, subdural abscess, meningitis or cerebral abscess, the opening is enlarged and the posterior wall of the frontal sinus is explored, preferably with a blunt probe. Should the sinus present any of these complications, adequate drainage should be instituted by removing the bony wall. A firm rubber drain is placed in the opening from the frontal trephination. This drain should have a loose fit and is held firmly in place by placing a suture through the drain tube and the skin. Do not attempt to interfere with the nasofrontal duct. The less manipulation there is in this area the more rapid will be the return to normal drainage through the nasofrontal duct to the nose.

Drainage is usually obtained in three to five days, and the tube is left in place for approximately an additional five to seven days. The drain tube should be of sufficient length so that there is easy access to the free end of the tube, permitting the frequent instillation of a solution of penicillin. The strength used is 100,000 units per cubic centimeter; and 3 to 5 cc. are instilled every three hours.

The dressing is dry except for boric acid ointment placed in and around the eye. The type of dressing is important in that the usual figure-of-eight dressing around the head slips out of place too readily, especially in young or unruly patients. The dressing used is a Montgomery strap. It is made from strips of adhesive tape, 1½ inches (3.8 cm.) wide and 6 to 8 inches long (15 to 20 cm.), with two or three eyelets placed at one end of the individual strap. The strap is used in pairs; one is placed over the opposite side of the forehead and one over the parotid region of the side operated on. Ample fluff dressing is used, and the straps are tied together with string. The dressing can be changed frequently without discomfort to the patient.

Penicillin was first used in doses of 15,000 units every three hours, totaling 120,000 units in twenty-four hours; this dose has been increased to 100,000 units every three to eight hours and is used intrathecally when indicated. The intrathecal dose used has been 50,000 to 100,000 units at each spinal puncture, usually daily, or more frequently if needed.

This dose is administered to the patient on admission and is kept up until he is discharged, the dosage being altered when indicated. The patient is watched closely for signs of sensitivity; this should be done especially with all patients with any history of allergy or allergic background.

One patient in this series reacted with a flare-up after administration of 11,500,000 units of penicillin over a seven month period, but it cleared up with change of the brand of penicillin used.

With the advent of penicillin, complications have decreased and the mortality rate has shown a definite drop. The greater the number of units of penicillin used in a given patient, the more rapid the recovery, provided adequate operation is performed when indicated.

Kahn [15] and Weille [16] reported similar findings and stated that penicillin therapy is an excellent adjuvant to well planned surgical procedure in these pathologic processes. Boyd [17] confirmed findings reported in this paper, that penicillin therapy is of value in chronic as well as acute suppurative frontal sinusitis. However, penicillin must be used with caution. Furstenberg [18] stressed this point and admonished that response to penicillin should come within seventy-two hours. If the patient is not relieved of symptoms by this time, treatment should be changed.

15. Kahn, K. M.: Role of Penicillin in the Management of Acute and Chronic Frontal Sinusitis, Arch. Otolaryng. **46**:293-306 (Sept.) 1947.

16. Weille, F.: The Problem of Secondary Surgical Treatment of the Frontal Sinus, Arch. Otolaryng. **45**:139-140 (Jan.) 1947.

17. Boyd, H.: Penicillin Therapy in Chronic Suppurative Sinusitis: A Case Report of 22 Cases, Laryngoscope **57**:460-478 (July) 1947.

18. Furstenberg, A. C.: Antibiotics in the Treatment of Diseases of the Ear, Nose and Throat, Ann. Otol., Rhin. & Laryng. **58**:5-18 (March) 1949.

In the more seriously ill patient, a blood transfusion is of great value. In the 3 patients for whom this was used, a definite and rapid improvement was noted. The transfusions were of 250 and 500 cc. quantities, and only one transfusion per patient was used in 2 cases.

SUMMARY

One hundred and forty-three cases of frontal sinusitis are reported, the total case load over the ten year period from 1938 to 1948 at the Los Angeles County General Hospital.

These cases are presented and ratios given for sex, race, age, season, predisposing cause, sides involved and mortality rate.

Also given are the type of operation used and the mortality rate for surgical procedures, with a consideration of the condition before and after the advent of penicillin.

The duration of hospital stay in cases with and without complications is presented, as well as the morbidity and mortality ratio between acute and chronic frontal sinusitis involving operation.

Eighteen cases of osteomyelitis, 12 cases of frontal sinusitis following swimming and 3 cases of mucocele are presented and discussed. Twelve cases are reported with absence of roentgenographic changes but with positive pathologic changes.

The treatment used is presented.

CONCLUSIONS

The rapidity with which treatment and operation is instituted in any given case of frontal sinusitis is of greatest importance in the recovery of a patient. However, cases vary, and the severity of the infection and virulence of the organism determine whether complications develop or the case terminates in recovery.

The incidence of frontal sinusitis has not dropped with the advent of penicillin therapy, but complications and deaths have decreased.

The duration of hospital stay has dropped nearly one-half in both complicated and noncomplicated cases since penicillin has been used.

The ratio of acute and chronic cases concerning complications remains about the same.

Frontal trephination in acute frontal sinusitis is the surgical procedure of choice. The procedure for trephination is presented.

98 North Madison Avenue.

BENIGN TUMORS OF THE ESOPHAGUS

Report of a Case of Neurofibroma

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BENIGN tumor of the esophagus is a rare disease. Patterson,[1] who published reviews on this subject in 1933, was able to find only 60 cases reported between 1712 and 1932. He reported aberrant thyroid, adenoma, cyst, fibroma, hemangioma, leiomyoma, lipoma, lipomyoma, myoma, myxofibroma, papilloma and polyps. Many of these were discovered incidentally at autopsy. Adams and Hoover[2] reviewed the literature from 1933 to 1943 and found 26 additional cases of benign tumors of the esophagus. The pathologic diagnoses of some of these were the same as some previously reported by Patterson. They added such tumors as benign giant cell tumor, neurofibroma, osteochondroma and three unclassified benign tumors. Adams and Hoover added 3 cases of their own, including 2 of fibroma and 1 of polyp. In 1944 Moersch and Harrington,[3] of the Mayo Clinic, reported 15 additional cases of benign tumors of the esophagus and added such tumors as fibrolipoma, which had not previously been encountered. They also reported the fact that in 7,459 postmortem examinations of patients who gave no history of esophageal difficulty, they found 44 benign tumors of the esophagus. Some of these findings had previously been reported.

Beeler, Collins and Hall[4] in 1948 reported a case of polyp of the esophagus. Therefore a review of the literature from 1712 to 1948 reveals a total of 148 reported cases of benign tumors of the esophagus.

1. Patterson, E. J.: Benign Neoplasms of the Esophagus, Pennsylvania M. J. **36**:244-246, 1933; Benign Neoplasms of the Esophagus: Report of a Case of Myxofibroma, Ann. Otol., Rhin. & Laryng. **41**:942-950, 1932.

2. Adams, R., and Hoover, W. B.: Benign Tumors of the Esophagus: Report of 3 Cases, J. Thoracic Surg. **14**:279-286, 1945.

3. Moersch, H. J., and Harrington, S. W.: Benign Tumor of the Esophagus, Ann. Otol., Rhin. & Laryng. **53**:800-817, 1944.

4. Beeler, R. C.; Collins, J. N., and Hall, M. F.: Benign Pedunculated Tumors of the Esophagus, Am. J. Roentgenol. **60**:466-470, 1948.

The first case of neurofibroma of the esophagus found reported in literature was published by Keefer, Schatzki, Churchill and Mallory [5] in 1937. It was an intramural extramucosal lesion and was successfully treated by surgical enucleation.

Kornblum and Bradshaw [6] in 1941 reported a case of neurofibroma of the esophagus which appeared to be extramucosal or extraesophageal, since it involved lung and esophagus. The patient did not survive the operative procedure. Schatzki and Hawes [7] in 1942 reported an intramural extramucosal lesion of the esophagus which was found at removal to be a neurofibroma of the esophagus. This was the second case of neurofibroma of the esophagus found in a search through the literature in which the lesion was causing symptoms, was successfully treated and the patient survived. Moersch and Harrington [3] reported the finding of a neurofibroma of the esophagus on routine postmortem examination of a patient who had presented no symptoms relative to the esophagus. The case we are reporting is the fourth reported case of symptomatic neurofibroma of the esophagus which was treated; the other was found incidentally at autopsy.

Dysphagia is the most frequent symptom in cases of benign tumor of the esophagus. Regurgitation and loss of weight may occur in the later stages, and there may be blood in the stool or emesis. According to the classification of Moersch and Harrington, if the tumor is of the intramural extramucosal type there may be a feeling of substernal discomfort as well as cough, expectoration and dyspnea. Pain is not present unless there is ulceration of the tumor or the adjacent esophageal wall.

If the benign tumor of the esophagus is a polyp or a tumor that has a pedicle, the history of regurgitation of a fleshy tumorous mass into the mouth makes the diagnosis easy. Otherwise, the history may be of little value in the diagnosis. The finding of an abnormal mediastinal shadow or widening in the roentgenologic examination of the chest may be a clue to the presence of a tumor of the esophagus. Roentgenologic examination of the esophagus is a great aid in establishing a diagnosis of benign tumor of the esophagus, but at times such tumors are difficult to differentiate from extraesophageal tumors com-

5. Keefer, C.; Schatzki, R.; Churchill, E. D., and Mallory, T. B.: Case Report of Neurofibroma of the Esophagus, New England J. Med. **217**:955-958, 1937.

6. Kornblum, K., and Bradshaw, H. H.: Intrathoracic Neurogenic Tumors, Radiology **37**:391-406, 1941.

7. Schatzki, R., and Hawes, L. E.: The Roentgenological Appearance of Extramucosal Tumors of the Esophagus: Analysis of Intramural Extramucosal Lesions of Gastrointestinal Tract in General, Am. J. Roentgenol. **48**:1-15, 1942.

pressing the esophagus and even malignant tumors of this structure. If there is splitting of the stream of barium sulfate or an uneven distribution on the roentgenogram, the roentgen examination should be followed by esophagoscopy. The mucosal covering of the esophagus in these lesions is usually intact unless ulceration has developed at the site of obstruction.

If the tumor is small and not producing symptoms, it may be well to leave it alone; however, owing to the fact that occasionally benign tumors of the esophagus may undergo malignant changes, early and prompt removal is the treatment of choice. Treatment of these tumors is by use of the snare, surgical diathermy or radium, and very large tumors and extramucosal intramural tumors are best handled by the transthoracic surgical approach.

REPORT OF CASE

The patient, a white woman aged 39, first reported to the medical department of the clinic March 1, 1949, with the chief complaint of "indigestion." She stated that for the past three years she had had intermittent attacks of nausea with occasional vomiting. She also described a feeling as of a knot in the upper part of her stomach and a sensation of food sticking in her chest. There had been some loss of weight, but the exact amount is not known.

Physical examination revealed a well developed, moderately well nourished woman of stated age appearing chronically ill but otherwise essentially normal. Routine laboratory study revealed a negative Kahn reaction, normal urine and hematologic values within normal limits.

A gastrointestinal study was done, and fluoroscopic examination of the esophagus revealed an obstruction at the junction of the upper with the middle third of the esophagus. The remainder of the study revealed an essentially normal-functioning stomach and duodenum. The diagnosis was tumor of the posterior mediastinum.

The patient was referred to the department of otolaryngology for further study, and esophagoscopy was done on March 14. At 26 to 30 cm. from the upper incisor teeth a semihard mass was noted bulging into the esophageal lumen from the left lateral and posterior walls, nearly completely occluding the lumen of the esophagus. The rest of the esophagus as well as the cardiac orifice appeared normal. The mucosa was intact throughout, and no ulcerations, bleeding or fungating masses were noted. The mass appeared to be in two lobules and apparently was transmitting pulsations. A biopsy specimen was not taken because of the intact normal mucosa. The impression was that the mass was an extra mucosal or extrinsic tumor of the esophagus.

The patient was referred to the department of surgery with a recommendation for exploratory thoracotomy. Exploratory thoracotomy was done on March 15, and the tumor was found in the posterior wall of the esophagus below the arch of the vena azygos. No extensions, metastasis or nodes were palpable. The tumor was enucleated from its position between the muscularis and the mucosa of the esophagus with moderate ease, and no openings were made into the mucosa of the esophagus. The patient made an uneventful recovery except for a positional palsy of the left arm, which rapidly disappeared.

Fig. 1.—A gastrointestinal study was done, and esophagoscopy revealed that at the junction of the upper with the middle third of the esophagus the stream of barium sulfate narrowed and flowed anteriorly around a lobulated mass approximately 8 cm. long situated posteriorly to the esophagus.

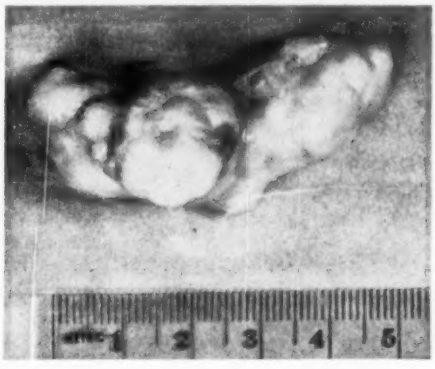

Fig. 2.—The tumor was ovoid and measured 5 by 3.5 by 3 cm. It was well encapsulated. It showed a slight amount of nodularity on the surface. Section revealed a central cyst, measuring 2 cm. across and lined with tumor tissue. The cut surface had a gray appearance, mottled in some areas by yellow flecks.

Fig. 3.—This area in the tumor shows a strand of spindle cells with the collagenous stroma—a neurofibroma pattern. Azure-eosin stain; × 200.

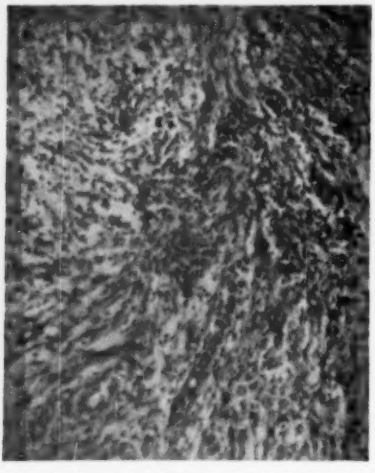

Fig. 4.—This field shows the looser texture of the tumor; near the midpoint there is a small clump of nuclei arranged horizontally, representing an incipient Verocay body—the neurilemma pattern. Azure-eosin stain; × 100.

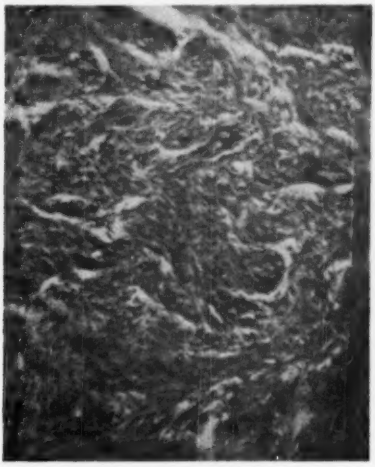

Fig. 5.—This portion of the tumor shows bundles that represent an attempt to form nerve structures—a neuroma pattern. Azure-eosin stain; × 200.

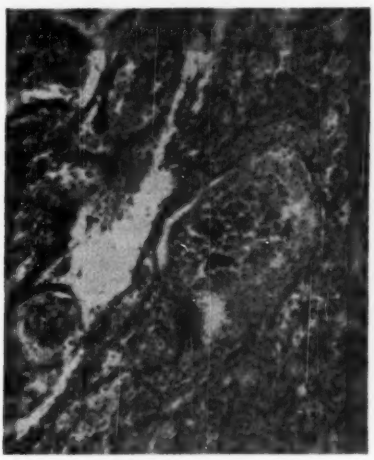

Fig. 6.—This field in the tumor shows a dilated blood vessel slightly to the right of the center. It contains lipid-laden phagocytes. The surrounding tumor tissue also shows clumps of clear cells which contain fat—the fibrolipoma pattern. Azure-eosin stain; × 200.

The patient was seen by the medical department six weeks after operation, and she was asymptomatic.

On the basis of the pathologist's report (figs. 1 to 6), the diagnosis of neurofibroma of the esophagus was made.

SUMMARY

A review of the literature of benign tumors of the esophagus is presented, and the report of the fourth case of symptomatic neurofibroma of the esophagus added to the literature on this rare type of tumors.

DISEASES OF THE EAR IN RELATION TO DISEASES OF OTHER ORGANS

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THE SPECIALIST has been facetiously described as one who "knows more and more about less and less."

Numerous authors have pointed out—and it is undoubtedly true—that the rapid development of the art and science of medicine has necessarily brought about a division into special fields with a consequential exaggeration of the trend and a tendency toward overspecialization.

The general practitioner, if he is to remain the ideal type of a physician, has all the more reason to be on the alert to perfect himself in the different fields of medicine and to keep abreast of the progress being made in these fields.

A conscientious specialist, on the other hand, will always be eager not only to master his own special sphere but, at the same time, not to lose contact with the good *alma mater medicinae* or to risk placing himself in the category of seeing only "the steeple of his own village."

With these considerations in mind, I shall attempt to show connections and transitions existing between diseases of the ear and other diseases of the body. It will be seen, for instance, that symptoms of the ear, such as tinnitus and impaired hearing, may be the earliest perceptible signs of a systemic disease (arteriosclerosis, nephrosis, etc.) and therefore should be recognized by the general practitioner as such. And by the same token, the relation of aural ailments and systemic diseases will be noted which should not escape the acumen of the specialist.

For the sake of clarity, these cross relations will be separated into groups of diseases and pathologic conditions on both a physiologic and an anatomic basis.

DISEASES OF METABOLISM

A. Diabetes Mellitus.—1. Diabetes and the External Ear: Among the diseases of the external ear that may be caused by diabetes mellitus is pruritus diabeticus, which, as part of the universal pruritus in diabetic persons, frequently has as its site of predilection the canal of the outer ear and the auricle. Opinion about the origin of the itching sensation is divided. Some physicians are of the opinion that an irritation of the

cutaneous nerves by the elevated sugar level of the blood is the cause. Naturally, there exist numerous other disturbances with itching of different origin, such as eczemas and, especially, mycotic processes in the aural canal, a *crux medici* as to treatment. It is obvious that—as this simple example shows—the ear specialist as well as the general practitioner should be on the alert lest they overlook a possible connection between purely local and systemic disturbances.

A urine test or examination of the blood sugar may in such cases lead to the detection of the underlying ailment and, at the same time, to the etiologic treatment of the aural disease. The itching will often disappear within a few days with strict management of the diabetes. Because in diabetes any small injury may lead to inflammatory changes or furuncles, the patient must be cautioned not to scratch the ear, more so probably than when the process is local. Especially to be feared are the phlegmons and necroses of the bones, which may develop in diabetic persons.

2. Diabetes and the Middle Ear: Suppuration of the middle ear was once considered to be in clear etiologic connection with this metabolic disturbance. The modern view is that here, as well as in the diseases of the outer ear, the severity of the otitis media in diabetic patients is directly related to the general systemic condition by virtue of the lowering of the resistance of the tissues.

Obviously, another important role is played by the deficient circulation and nutrition of the tissues due to arteriosclerosis, which is often coexisting in diabetic persons. In this way, the addition of an otitis media to a severe case of diabetes mellitus may aggravate the systemic disease considerably and even lead to a rapid coma, while, on the other hand, an otitis media in a diabetic patient may progress rapidly until there is the present picture of an enormous bone caries, sequestration and other serious complications.

Naturally, these more vicious complications have become very rare today due to insulin therapy and the effect of modern drugs such as sulfonamides and penicillin. The indication for any operation in persons with diabetes used to be a much debated question, and not the least of arguments against operation concerned the danger of anesthesia. There was a time when almost every operative procedure in diabetes mellitus was absolutely contraindicated, because there occurred so many deaths postoperatively, usually via coma. The modern point of view, of course, has changed since the introduction of insulin. When indicated, an operation need not be delayed after the diabetes mellitus has been brought under control, especially if it can be done with local anesthesia. Always keep in mind that the healing process may be retarded.

3. Diabetes and the Inner Ear: The participation of the inner ear in diabetes mellitus is of significance in two ways: First, as I previously stated, there may develop an encroachment of the bone caries on the labyrinth, even if the healing process seemingly is well on its way after a mastoid operation. Second, there exist also nonputrid changes of the inner ear in diabetes mellitus. These changes are probably inflammatory alterations of the nervus acusticus (degenerative neuritis) and of the labyrinth (neurolabyrinthitis) by toxins which circulate in the bloodstream in this general metabolic disturbance. In many of these cases arteriosclerosis also has its part in the picture. Impairment of hearing and subjective noises for the most part develop very slowly. The cochlear and the vestibular apparatus may participate in the process as well, but isolated attacks of one or the other may be found.

B. Gout.—Gout, caused by a disturbed metabolism of the purines, is manifested by deposits of uric acid in certain tissues (cartilage, bone, connective tissues), accompanied with inflammatory processes. It is therefore understandable that these manifestations can easily appear within the ear, which is abundantly provided with the aforementioned types of tissue.

1. Gout and the External Ear: The deposits of uric acid within the auricle are well known as "tophi." The reason for the frequent appearance of these structures at this area is the slow blood circulation in the bloodless cartilage. The murexide test can identify uric acid in these deposits, where a differential diagnosis must be made for atheromas. There may also be present during an attack of gout hyperemia and congestion, itching and shooting pains in the auricle without the existence of tophi or before they are sufficiently developed to be recognizable.

In the outer aural canal one can often find exostoses in gout sufferers, especially in England, the classic "gout country." Occasionally, the acute gout attack may be localized in the region of the mastoid process, a fact which may lead to diagnostic misinterpretations.

2. Gout and the Middle Ear: A specific "goutic otitis media," as described in some old textbooks, has never been satisfactorily proved, but urate deposits can occasionally be found in the small joints of the ossicles, in the cartilaginous cover of the hammer, anvil and stapes and also in the cartilage of the eustachian tube. These deposits should not, as is sometimes the case, be confused with otosclerosis or stapes ankylosis.

3. Gout and the Inner Ear: Gout sufferers often complain of dizziness, tinnitus and impaired hearing. The cause in most cases is probably a toxic neuritis acustica as a result of the increased uric acid

in the blood. The subjective and objective symptoms in most such cases respond favorably to reduction of the uric acid level (purine-free diet, cinchophen N. F. [atophane]).

DISEASES OF THE DIGESTIVE APPARATUS

A. Oral Cavity.—It is known that patients with decay or other dental ailments frequently come into the office of an otologist; the reverse is also often the case. The reason can be found in the nervous relation of the teeth and the ear. It seems appropriate to consider briefly the errors that may occur in the differential diagnosis in pain in the region of the ear without a disease process of the organ itself. The origin of these so-called earaches may be the teeth, the tonsils, the maxillary joint, the lymph glands and myalgias and neuralgias, especially around the sternocleidomastoid muscles and the occipital nerve.

There exist numerous anastomoses between the branches of the trigeminus nerve, which supplies the teeth and the sensitive nerves of the external and middle ear (the fifth, ninth and tenth).

Radiating pain may travel from the tooth to the region of the ear over the ganglion oticum and ganglion sphenopalatinum. The picture of "dentogenic otalgia" is rather characteristic. Patients complain of shooting pain, usually in the depth of the ear, rarely in the mastoid process, mostly on one side only and in intervals and frequently starting at a certain hour during the night. Among the dental disorders most frequently leading to "otalgia" are the chronic pulpitis of the lower molars with preceding caries, gangrene of the pulp, remnants of roots, overlapping metal fillings of the lower molars and, last but not least, pressure of the wisdom tooth on the root of the second molar.

The differential diagnosis often is not easy. If all other causes for the "earache" can be readily excluded—such as chronic tonsillitis with concrements in the upper pole—one should never forget the teeth and in such cases should cooperate with the dentist, who can, with his diagnostic aids such as electric induction current and roentgenography, often assist in establishing the fact that the real difficulty is dental. The retention of molar teeth and the *dentitio difficilis* of the wisdom tooth as a cause for earache are of special importance within the problem. Besides the described neurologic interrelations, there are certain "acoustic reflexes" to be mentioned, by which the nervous correlation between ear and teeth can be illustrated.

Occasionally, tinnitus may be observed with diseases of the teeth, and, on the other hand, certain acoustic sensations may lead to painful disturbances of the teeth. High pitched, shrill tones (e. g. scratching on glass or stone) may be "perceived" by many people within their teeth—especially by sensitive persons—and more so if they have a diseased tooth. The composer Rubinstein and the famous surgeon

Billroth are said to have felt severe toothaches when someone sang out of tune. Billroth once discovered a carious tooth in this way. There also exists the reverse, an "otogenic dentalgia," which may be caused by an otitis media or even pressure of a ceruminal plug.

One might, furthermore, be reminded of the premature loss of a molar, resulting in a closed bite and exerting pressure on the outer aural canal with impaired hearing.

Finally, the dental condition known as periodontoclasia is being recognized more and more as an etiologic factor for radiating pains, which may easily be mistaken for earache.

B. Stomach and Intestines.—Subjective aural noises and impaired hearing, occasionally encountered in stomach ailments, especially ulcus ventriculi, certainly can be attributed to secondary anemia. On the other hand, the same symptoms may be caused by hyperemia of the brain or the inner ear in cirrhosis of the liver and chronic constipation. Hemorrhage within the ear may often be seen after prolonged jaundice. The effect of aural diseases on the stomach and the digestive tract may be multiform. Inflammatory infiltration and furuncles of the aural canal may spread to the jaw joint and in this manner disturb the food intake, especially in children. Aural ailments are of special significance because of their effects on the stomach and bowels of infants and young children.

However, the theory that otitis media is caused by a bowel ailment because of contamination through the eustachian tubes by vomitus is not proved. In general, the otitis media comes first and disturbances of the child's intestinal tract follows.

Well known is the reflex mechanism on the stomach and intestinal tract, such as nausea, vomiting and even diarrheas due to vestibular irritation in air, sea and car sickness and in Ménière's symptom complex.

DISEASES OF THE RESPIRATORY ORGANS

The numerous anatomic and physiologic relations between the ear and the upper respiratory tract make understandable the frequent relation pathologically. The continuity afforded by the eustachian tubes is the basis for the spread of most infections into the middle ear.

Not so commonly known, but interesting and important, are certain connections between the ear and the larynx. Pain around the epiglottis and larynx is not rarely referred to the ear. In swallowing, especially empty swallowing, patients with tuberculosis and carcinomas, and those with unspecific processes, often complain of pain in the ear. The reflex probably is conveyed through the vagus which is the sensory nerve of the larynx and which also sends a branch into the outer aural

canal (auricular nerve [Arnold]). Well known is the reflex cough brought about by manipulation of the aural canal or through pressure of wax.

In the course of pertussis, disturbances may occasionally be encountered in the ear during a convulsion, such as congestion and elevated tension in the blood vessels of the larynx and the ear, followed, even, by hemorrhages.

DISEASES OF THE CIRCULATORY ORGANS

It is obvious that pathologic changes in an organic system as important for the whole organism as the circulatory apparatus will also affect the ear. Moreover, the ear may react to circulatory disturbances early in the disease at a time when no other symptoms are yet manifest because of the ear's extraordinary irritability and low resistance. The vessels of the cochlea are end arteries in the sense of Cohnheim.

Arteriosclerosis.—The outstanding site of the damage in arteriosclerosis is the inner ear. At relatively early ages, between 40 and 50, in the so-called state of presclerosis, diseases of the sound-perceiving apparatus may be based on arteriosclerotic changes.

Pathologically and anatomically there may be atheromatous vascular changes and a degenerative atrophy of Corti's organ. Among the first symptoms of arteriosclerotic disease of the inner ear are the subjective aural noises. These noises occur, as in cardiac diseases, sometimes only in the morning as the patient assumes the upright position (due to an anemia of the labyrinth); they can be caused to subside by the patient's resuming the horizontal position. Before many months go by progressive reduction in hearing occurs in persons with such conditions.

The functional hearing test in such cases will show a shortening of bone conduction and a lowering of the upper tone limit (in contrast to that in otosclerosis). The vertigo of arteriosclerotic patients is mostly of a cerebral nature, because the static part of the inner ear is much less affected, the nervus vestibularis, possessing a much greater capacity for resistance to the process, being considerably older phylogenetically than the cochlear part. "Otalgia angiosclerotica" is the name for certain unpleasant and even painful sensations within the ear, which are caused by a diminished or interrupted circulation to the sensory nerves. The treatment of the aforementioned conditions is directed toward improving the circulation as far as possible throughout the body and, more specifically, to the structures of the ear.

Vasomotor disturbances may lead to spontaneous bleeding in the ear, especially in nervous and hysterical persons. The disturbances within the ear in migraine also may be of vasomotor origin. There

exist angioneuroses of serious degree in which occur apoplectiform symptoms similar to that in Ménière's syndrome.

Persons with functional conditions, such as neuroses, hyperthyroidism and hypothyroidism and those convalescing from severe ailments are often subject to aural noises such as audible heartbeats. In such cases the labile cardiovascular mechanism may be producing a localized state of malnutrition or anemia of the acoustic area by virtue of the altered blood flow. Sometimes aural noises are venous in origin and are usually of a blowing and breathing character, as in the jugular vein of anemic persons.

Emboli, as from an acute bacterial endocarditis, may lodge in an aural vessel, which may result in a sudden onset of deafness and Ménière's symptom complex.

RELATION TO SEXUAL FUNCTION

Connections between the aural and the sexual sphere are more frequent in women than in men, a fact easily explained by the strong influence which the physiologic events in the sexual organs (menstruation and gestation) exert on the system in general and on the sense organs in particular.

A. Menstruation.—Menstruation in many women is accompanied with a variety of manifestations. Certain vasomotor sensations at the auricle, such as reddening or swelling, may occasionally be observed. In nervous and hysterical women hemorrhages may occur in the ear during the menstrual period as "vicarious bleedings," the same as in other areas of the skin and mucous membranes. Furthermore, tinnitus and dizziness due to labyrinthine irritation are often complained of at the onset of the period.

B. Pregnancy.—Because of the changes in endocrine balance and those of the entire blood circulation which take place during pregnancy, disturbances of many types may appear in all parts of the ear.

Formation of varicose veins and hemorrhages from the aural canal and from the drum membrane are sometimes found during and after pregnancy; suppurative processes of the middle ear may be aggravated. Pregnancy, especially repeated pregnancy, is able to exert an adverse influence on otosclerotic processes, possibly because of the altered calcium metabolism. Diseases of the puerperium may affect the ear, an example being the septicemia of a severe puerperal fever with its embolic phenomena, which may involve the ear.

C. Menopause.—It is not surprising that the climacterium is not without influence on the ear. Furunculosis and eczematous conditions of the outer ear and aggravation of already existing diseases, especially otosclerosis, are fairly common occurrences.

D. Aural Stimuli.—More physiologic than pathologic, but nevertheless serving to point out the relation of the ear to the sex organs, are the stimulation of the sexual desire by mechanical stroking of the outer ear and the aural noises described by some masturbators (via nervus sympathicus and nervus auricularis vagi).

DISEASES OF THE KIDNEYS

Visual disturbances in nephritis are, of course, very common. But what of the ear in ailments of the urinary tract?

Hemorrhages from the aural canal and the middle ear such as petechiae or severe bleedings, even followed by deafness, have been seen in cases of nephritis and usually are to be considered as a bad prognostic sign. Such bleeding is usually the result of very high blood pressure and serious alterations in the walls of the blood vessels. As in diabetes mellitus, there is frequently an exacerbation of acute or chronic otitis media, parallel to an aggravation of a nephritis. The phenomenon of intermittent deafness of the inner ear type has been observed and is probably explained by the appearance and disappearance of edemas of the nervus acusticus and its central paths.

Degeneration of the labyrinth may possibly be induced by the accompanying acidosis or hemorrhage into the labyrinth. On the other hand, changes in the vascular system in nephrosclerosis may lead to corresponding changes in the ear. A prognostically unfavorable sign in nephritis is the lowering of the upper tone limit on the audiogram.

DISEASES OF THE HEMOPOIETIC ORGANS

A. Leukemia.—Aural symptoms as a feature of the leukemias are often encountered; they are commoner in the male because leukemias occur oftener in the male. Hemorrhages and lymphatic infiltration usually account for the primary damage, and this is followed by secondary degenerative changes. Most frequently the nerve ganglion apparatus of the auditory nerve is affected and less often the labyrinth itself or the structures of the middle ear. The clinical symptoms are determined by the localization of the bleeding. Thus, a sudden hemorrhage into the labyrinth will lead to the sudden onset of a Ménière symptom complex. Bleeding of the middle ear (hematotympanum) often leads to an acute otitis media through secondary infection.

B. Anemia.—In secondary as well as in primary anemia as a result of labyrinthine anemia are frequently found tinnitus, vertigo and deafness. Bleeding into the labyrinth, as into the retina, may sometimes occur. Freezing of the auricle is more likely to happen in anemic than in well persons.

C. Hemophilia and Hemorrhagic Diathesis.—It is readily seen that the hemorrhagic diseases can produce bothersome hemorrhages into the various portions of the aural structures as a part of the general situation, but occasionally an aural hemorrhage may be the first sign of a disease of this group. In general, it may be said that a blood study is indicated in any aural hemorrhage not easily explained on another basis.

GERIATRICS AND THE EAR

In conclusion, a brief survey of the changes in the ear in old age may be added.

One can consider the aging process as failure of the reparative power to counteract the wear and tear of the organism, especially of the germinative glands and the brain. But this observation does not explain everything.

The typical changes of age in the ear concern the inner ear. The acuteness of hearing diminishes with older age in every person. Most people do not notice this fact at the onset until they observe more and more the loss of sensitivity to high pitched tones (bell, whistle). In presbyacusis, via functional testing, are found a marked reduction of the upper tone limit and a shortening of duration for high tones, followed by a diminution of hearing for all tone qualities. The onset of presbyacusis cannot generally be predicted, but it usually occurs between the ages of 50 and 70.

Opinion as to its cause is divided; probably several factors are responsible: (*a*) progressive labyrinthine changes, in the sense of wear and tear; (*b*) atheromatosis with degenerative changes of the labyrinth, the acoustic nerve and the brain, and (*c*) a certain rigidity of the membrana basilaris, progressing from its summit to the base.

Means to delay or retard these processes are still eluding detection, and the "fountain of youth" still exists only in fairly tales.

TREATMENT OF EMPYEMA OF THE SELLA TURCICA OF SPHENOID ORIGIN

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OSTEOMYELITIS of the sphenoid sinus though unusual is not rare. Courville and Rosenvald [1] in a series of 15,000 consecutive autopsies found this disease present in 22 cases. The immediate cause of death in these cases was meningitis or thrombosis of the cavernous sinus. Most frequently, a combination of the two was found. An acute sinusitis is more apt to result in intracranial extension than a chronic process.

Extension from the infected sphenoid sinus may occur in the following manner.

First, it may occur by the presence of a congenital defect in the bony wall. A vascular band may persist and escape pneumatization between the presphenoid and the alisphenoid bone, forming a direct intracranial route for extension.[2]

Second, it may occur by way of veins which connect the interior of the sphenoid to the cavernous sinus.

Third, latent osteomyelitis of the sphenoid may be reactivated by trauma, with consequent cerebral extension.[3]

Fourth, there may be direct extension by osteomyelitis. Extension in this manner may produce infection within the sella turcica.

Grant [4] in 1931 reported an autopsy of a patient with an abscess of the sphenoid sinus and rupture into the pituitary fossa. This patient died ten days after the onset of severe headache. One would think that

1. Courville, C. B., and Rosenvald, L. K.: Intracranial Complications of Infections of Nascal Cavities and Accessory Sinuses, Arch. Otolaryng. **27**:692 (June) 1938.

2. van Gilse, P. H. G.: Investigations on the Development of the Sphenoidal Sinus, J. Laryng. & Otol. **41**:137 (March) 1926.

3. Kaufman, A., and Hartmere, S. J.: Latent Osteomyelitis of the Sphenoid Reactivated by Trauma with Death from Meningitis, Laryngoscope **44**:477, (June) 1934.

4. Grant, A. L., Jr.: Acute Abscess in Body of Sphenoid, Ruptured into the Pituitary Fossa: Autopsy Report, Laryngoscope **41**:842 (December) 1931.

this extension would be most common when the proximity of these structures is considered. Nevertheless, this is the only reference which we have been able to find to this type of extension.

Osteomyelitis of the sphenoid is much less common than osteomyelitis of the other sinuses. Eagleton [5] expressed the belief that the blood supply within red bone marrow explains the peculiar protective powers of the sphenoid base. This increased resistance is present in other red bone-marrow-containing structures, such as the segmented portion of the occipital bone, the vertebrae, the ribs and the os innominatum. Yellow acellular fat marrow very rapidly reconverts to cellular bone marrow in an effort to control infection.

It is generally understood that osteomyelitis for its complete control must have both surgical and antibiotic treatment. In osteomyelitis, penicillin alone is not adequate. Surgical procedure together with penicillin administered intramuscularly and locally is the treatment of choice. This therapy was successful in the case reported here.

REPORT OF A CASE

A 65 year old white man was admitted as a patient of Dr. James T. Daniels, neurosurgeon, to St. Vincent's Hospital, on April 21, 1946, with a chief complaint of headache of one month's duration. The headache began with a chill while he was at work. Later in the evening he experienced a viselike excruciating headache and projectile vomiting. Soon thereafter diplopia developed together with a peculiar visual difficulty, whereby objects in the lower fields seemed clearer. He noticed continuous and severe thirst and increased urinary output. There was general malaise and dyspnea on exertion.

The past history was noncontributory except for a hearing deficiency following diphtheria at the age of 10. He has had anosmia since childhood.

Neurologic examination revealed bilateral anosmia, probably due to chronic ethmoiditis with secondary atrophy of the nasal mucous membrane. There was concentric restriction of the visual fields, some limitation of the upward gaze, ptosis of the right lid and paralysis of the lateral rectus on the right. The deep reflexes were slightly more active on the left side. The optic fundi showed arteriosclerotic changes bilaterally with tortuosity of the vessels. The right disk margin was hazy.

Laboratory Observations.—The results of the urinalysis and blood count were within normal limits, and the Kahn reaction of the blood was negative. Spinal tap showed clear fluid with 21 segmented granulocytes (polymorphonuclear leukocytes) per cubic centimeter. Spinal fluid culture after four days was sterile. Guinea pig inoculation gave negative results.

Roentgenograms of the skull (fig. 1) revealed bone erosion and destruction of the sella turcica, involving particularly the dorsum sella and posterior clinoid processes with erosion and flattening of the fossa. This condition was believed by the roentgenologist, at the time, probably to be due to the presence of primary neoplasm.

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5. Eagleton, W. P.: Meningitis—Result of Disease of the Petrous Apex and Sphenoidal Basis, Surg., Gynec. & Obst. **60**:586 (Feb., no. 2 A) 1935.

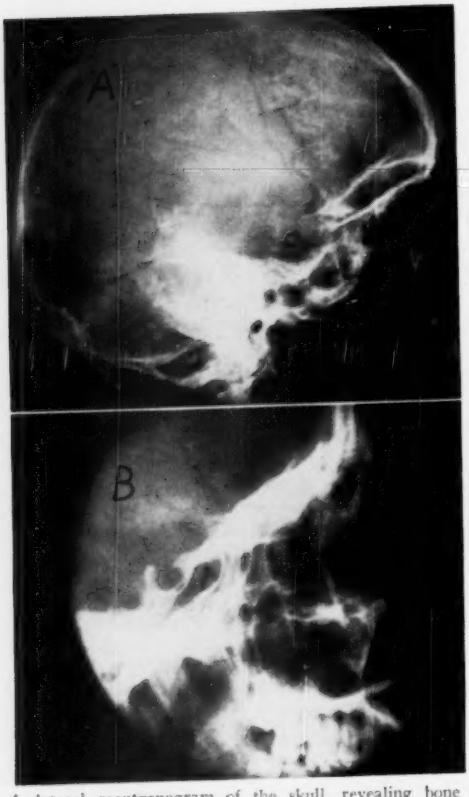

Fig. 1.—*A*, lateral roentgenogram of the skull, revealing bone erosion and destruction of the sella turcica. *B*, comparative roentgenogram of the lateral sinus, demonstrating a normal sphenoid sinus and sella turcica.

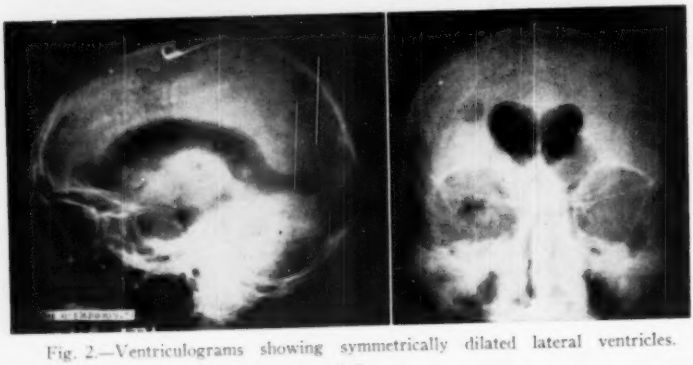

Fig. 2.—Ventriculograms showing symmetrically dilated lateral ventricles.

On April 25 a ventriculogram was made (fig. 2), which showed symmetrically dilated lateral ventricles without displacement.

Immediately after the ventriculogram, Dr. Daniels performed a craniotomy, since he felt that, in view of the destruction of the sella turcica with intracranial signs, there was some extension of the lesion projecting intracranially from a primary focus about the sella turcica and that perhaps removal of the neoplasm might be possible.

Procedure (J. T. D.).—With the patient under endotracheal ether, a coronal incision was made and the scalp over the frontal area reflected down to the level of the supraorbital ridges. A right osteoplastic bone flap was then made, maintaining the attachment of the temporalis, and the dura was then gently stripped from its intimate association with the roof of the orbit; the region of the chiasm was thus exposed. The chiasm was fortunately post fixed. The inferior

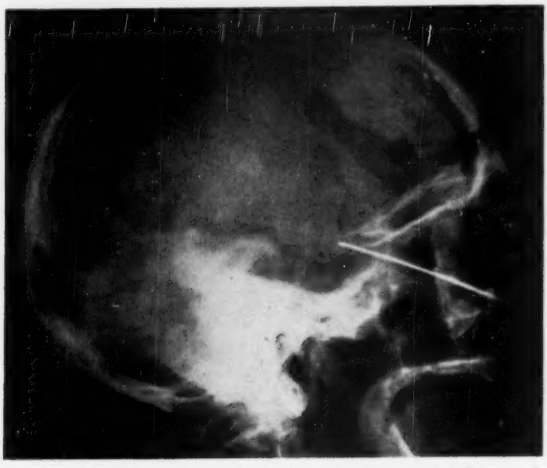

Fig. 3.—Lateral roentgenogram of the skull, showing a sphenoid cannula passed nasally through the left sphenoid sinus and without resistance into the sella turcica.

portion of the third ventricle seemed to be bulging. The condition of the right was not unusual, and the right internal carotid artery failed to reveal any abnormality. The diaphragma sellae was then palpated. It was only moderately tense but seemed to be bulging and was rather boggy on palpation. A needle attached to a syringe was then passed through the diaphragma sellae and suction was made, when, very greatly to our surprise, a very thick yellow viscid pus was withdrawn. All the structures about the exposure were carefully protected with lintin. The needle was then carefully withdrawn and the wound closed immediately.

On April 27, one week after admission, an otolaryngologic consultation was requested. At this time the patient showed considerable mental confusion and complained bitterly of excruciating vertex headache.

Ear, Nose and Throat Examination.—There was a thick creamy postnasal drip in the throat.

Both tympanic membranes showed normal landmarks.

There was cystic degeneration of both middle turbinate bodies. It was possible to enter the left sphenoid sinus with a cannula (fig. 3). Instead of the usual hard posterior sphenoid wall, soft, nonresisting tissue was encountered. On removal of this cannula a flow of pus came from the sphenoid ostium. Culture of this pus showed hemolytic Staphylococcus aureus.

On the eleventh hosiptal day, May 2, an ethmoidectomy on the left and uncapping of the anterior sphenoid wall were done. On opening the sphenoid sinus, we encountered about 10 cc. of liquid pus, which was suctioned away. With a curved probe, the sphenoid cavity was palpated. There was no intersphenoid septum, and the posterior wall consisted of resilient grayish membrane. Into the resulting large sphenoid-sella-ethmoid cavity, a mushroom catheter

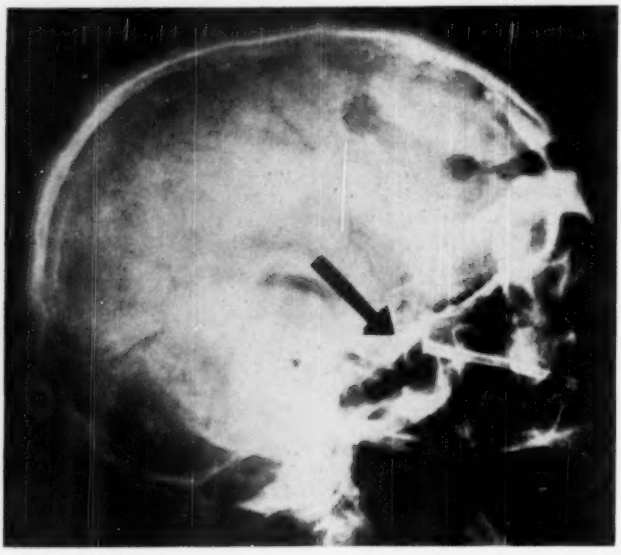

Fig. 4.—Lateral roentgenogram of the skull, showing tip of mushroom catheter in the postoperative sphenoid-sella-ethmoid cavity.

was fitted (fig. 4). The catheter held itself nicely in place and showed no tendency to slip away. The right sphenoid sinus was not opened, for we felt that the intersphenoid septum had melted away and the drainage of one side would be sufficient for both sphenoid sinuses.

On the patient's returning to bed, a continuous drip of penicillin solution (500 units per cubic centimeter) was run into the mushroom catheter at the rate of 60 drops per minute. He also received 20,000 units of penicillin intramuscularly every three hours.

The following postoperative notes were made.

May 3 (first postoperative day). "Remarkable improvement in sensoria and general well-being. No headache.

May 4 (second postoperative day). "Maintains improvement and answers questions clearly, with no difficulty in hearing conversational voice."

May 5 (third postoperative day). "Patient entirely clear mentally. There is no diplopia." On this day the catheter was removed.

May 6 (fourth postoperative day). "Neurologic examination revealed no abnormality."

On the tenth postoperative day the patient was allowed up. There were no complaints. Eleven days later he was discharged from the hospital.

He was then given follow-up observation as an ambulatory patient for one year during which time the sphenoid sinus remained open, and although there was occasional crusting in the sphenoethmoid recess, there was at no time any liquid pus. He returned to his work as an elevator examiner and has been well since.

SUMMARY

A case is reported of empyema of the sphenoid sinus associated with osteomyelitis of the sphenoid bone, with a complicating extension into and erosion of the floor of the sella turcica. The patient was treated with a combination of intranasal surgery and local administration of penicillin. After a careful search of the literature only one other case (Grant [4]) of extension into the sella turcica from the sphenoid sinus was found reported, an autopsy report. There has been no similar case with recovery.

We have described a novel method by which penicillin may be applied topically and continuously to the sphenoid sinus. In this manner, too, the products of infection and bone destruction are washed away.

CONCLUSIONS

1. Intracranial extension from osteomyelitis of the sphenoid sinus results usually in thrombosis of the cavernous sinus or meningitis or a combination of both. It is possible, however, for infection of the sphenoid sinus to extend directly into the sella turcica.

2. The treatment of choice is surgical procedure and penicillin administered locally and parenterally.

PRIMARY CARCINOMA OF THE TRACHEA

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MARSHALL U. SIMON, M.D.
AND
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PRIMARY carcinoma of the trachea is a comparatively rare neoplasm encountered in the tracheobronchial tree. A search of the literature to 1949 uncovered but 211 cases. One of us (M. R. G.) reported 1 case in 1936, and this present case is his second in twenty-five years of observation. This infrequent occurrence prompts the report of this case. A perusal of the literature discloses only fifteen papers dealing with the subject, and three of these, by Culp [1] in 1938, Ellman and Whittaker [2] in 1947 and Engler [3] in 1948, present excellent reviews of the subject.

From the pathologic point of view these tumors are found to involve mostly the distal third of the trachea, in the posterior wall, with frequent extension to the lateral wall on either side. Histologically, they may be classified in three groups: squamous cell carcinoma, adenocarcinoma and basal cell carcinoma. The squamous cell type is referred to by most authors as being the commonest. Ellman and Whittaker,[2] however, in a study of the histopathology in 120 cases, classified 47 per cent as adenocarcinoma, 41 per cent as squamous cell carcinoma and 12 per cent as basal cell carcinoma. The main difficulty in classifying these neoplasms lies in a lack of uniformity of opinion, not only as to their pathology but also as to their clinical expression, of being either malignant or relatively benign lesions. The type that is the cause of the greatest confusion is the so-called cylindroma, although it is the growth least frequently encountered. One of us (M. R. G.),[4] from a study of these lesions, is convinced that they fall into a well delineated group of basal cell carcinomas, with their comparatively benign course. Segura,[5] in fact, classified them as benign neoplasms. Ellman and Whittaker [2] cited

Presented before the Chicago Laryngological and Otological Society, April 3, 1950.

1. Culp, O. S.: J. Thoracic Surg. **7**:471, 1938.
2. Ellman, P., and Whittaker, H.: Thorax **2**:152, 1947.
3. Engler, C. W.: Ann. Otol., Rhin. & Laryng. **57**:429, 1948.
4. Guttman, M. R.: Ann. Otol., Rhin. & Laryng. **45**:894, 1936.
5. Segura, E. V.: Ann. de mal. de l'oreille, du larynx **39** (pt. 2):162, 1913.

references in which this type of growth is described as adenocarcinoma. There is further difference of opinion about the origin of these tumors. Most authors expressed the opinion that these growths are a result of metaplasia, while others, especially Ellman and Whittaker,[2] subscribed to the theory of embryonal rests of the primitive branchial cleíts, the esophagus and the thyroid, which fail to develop along the usual lines. They stated that these tumors may also originate from cells normally found in the trachea, the embryonic basal cells of the tracheal mucosa. Womack and Graham[6] supported the theory of embryonal rests, especially as it concerns the related pulmonary neoplasms known as bronchial adenomas. Although these neoplasms extend by local infiltration, distant metastasis is uncommon, and when it does occur microscopic study will show it to be of the squamous cell type. Partridge,[7] however, reported 2 cases in which the local lesion had the histologic appearance of a squamous cell neoplasm, while the distant systemic metastasis presented a histologic picture of an "oat cell" tumor.

Patients afflicted with a primary carcinoma of the trachea have the two characteristic symptoms of slowly increasing dyspnea and an associated wheeze, which eventually becomes a definite stridor. Cough is infrequent, and hemoptysis rare. Later obstruction becomes more pronounced and results in secondary pathologic change of the distal portions of the tracheobronchial tree, in the nature of atelectasis, emphysema, bronchiestasis and, occasionally, pulmonary abscess. The signs and symptoms of these sequelae become superimposed on the picture of progressive dyspnea and wheezing. It is amazing to realize that for the most part the diagnosis is missed until late in the disease. Usually the patients are labeled as persons with asthma and treated as such. Roentgenographic studies reveal few findings in the early course of the growth. Later, in a very small number, the roentgenogram may reveal a narrowing of the airway and an infrequent erosion of the tracheal cartilage. Tomography was found by Tobias[8] to be superior to the flat plate in the discovery of these lesions. Contrast studies with iodized oil U. S. P. (lipiodol®) were also of assistance in delineating the pathologic condition. Papanicolaou's studies were uniformly unsuccessful in identifying tracheal lesions, in contradistinction to the not infrequent positive findings of cancer cells in the lesions involving the distal portions of the bronchial tree. In the case to be reported, repeated flat plate studies gave negative results, as did the Papanicolaou stain with both the sputum and the exudate obtained by direct suction of the lesion itself through the bronchoscope.

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6. Womack, N. A., and Graham, E. A.: Mixed Tumors of Lung: So-Called Bronchial or Pulmonary Adenoma, Arch. Path. **26**:165 (July) 1938.

7. Partridge, J. F.: Brit. J. Surg. **37**:48, 1949.

8. Tobias, J.: Rev. méd. cubana **57**:809, 1946.

By far the most reliable way to establish the diagnosis is by bronchoscopy and biopsy of the tumor.

The treatment consisted mainly in the bronchoscopic resection and destruction by electrosurgery, followed by roentgenologic therapy. Excellent results have been reported by Guttman,[4] Engler,[8] Penta [9] and Fisher [10] with such a regimen. Transcervical surgical resection was successfully done by von Bruns [11] in 1898 and Olsen [12] in 1939.

REPORT OF A CASE

L. R., a 49 year old white man, single and of Syrian descent, was admitted to Mount Sinai Hospital, Chicago, on May 14, 1949. By occupation, he was the manager of an electric appliance store.

His chief complaint was recurrent attacks of dyspnea, which started to come on suddenly several months before. The first attack occurred while he was at work, and he was seen as an emergency patient by a neighborhood physician. A diagnosis of asthma was made, and he was given an injection which alleviated the attack.

He had recurrent attacks which varied in severity from a slight loss of breath to marked difficulty in breathing that necessitated heaving of the chest to inspire air. He changed physicians several times without benefit. At times he had mild coughing spells and infrequently would cough up small particles of what appeared to be clotted blood. He denied any dyspnea on exertion, and at no time did he notice cyanosis or pitting and swelling of the ankles.

His allergic history with regard to eczema, migraine, sneezing, hay fever or food idiosyncrasy was noncontributory, for himself as well as his parents. He had smoked two to three packages of cigarets a day, but he stopped smoking with the onset of his present illness. His appetite had become increasingly poor, and he was certain that he had lost a great deal of weight. At that time he changed physicians once more and consulted Dr. Louis Terman. After a physical examination and roentgenologic study, he was advised by Dr. Terman that there were no characteristic "groaning noises" in his chest. Dr. Terman doubted the diagnosis of asthma and referred him to one of us (M. R. G.) for bronchoscopic study as well as for roentgenographic examination of the chest with iodized oil U. S. P.

His past history, family history and general systemic review were noncontributory with relation to his complaints.

Physical Examination.—The patient was a well developed, well nourished, white man apparently 50 years of age, alert, cooperative and not ill except for a slight dyspnea and an expiratory wheeze that could be heard with the unaided ear. His temperature was 99 F., and his pulse rate was 80, with 28 respirations per minute. The systolic blood pressure was 134 and the diastolic pressure 84. Examination of his eyes, ears, nose and throat indicated no abnormalities. There were a few small palpable lymph nodes found in both posterior triangles of the neck, but inasmuch as they were neither hard nor fixed they were thought to be insignificant. The thorax was moderately emphysematous, but expansion was equal

9. Penta, A. Q.: Ann. Otol., Rhin. & Laryng. **56**:790, 1947.

10. Fisher, G. E.: South. Surgeon **13**:78, 1947.

11. von Bruns, P.: Beitr. z. klin. Chir. **21**:284, 1898.

12. Olsen, A. M.: Carcinoma of Trachea, Arch. Otolaryng. **30**:615 (Oct.) 1939.

and adequate. Tactile fremitus was normal, both sides were slightly hyperresonant to percussion, and auscultation disclosed bilateral rhonchi and wheezing, both anteriorly and posteriorly. The abdomen and extremities, as well as the reflexes and sensorium, were normal.

Laboratory Observations.—The hemoglobin was 15.2 Gm., and the color index was 0.95. The white cell count was 7,800 and the red cell count 5,900,000, with

Photomicrograph showing infiltration with stratified squamous epithelium, which presents mild variations in size, shape and staining qualities. Many nuclei are enlarged and deeply hyperchromatic (*a*). The growth is fairly well differentiated. Mitotic figures are abundant (*b*). × 119.

66 per cent segmented cells, 26 per cent small lymphocytes, 6 per cent monocytes and 2 per cent eosinophils. The reaction to the Kahn-Kline test was negative. The blood sugar content was 109 mg., the urea nitrogen, 13.2 and the total protein, 6.5 Gm., per hundred cubic centimeters, with 4.4 Gm. albumin and 2.1 Gm. globulin, a ratio of 2.1. The sedimentation rate was 13 and the hematocrit value 48.

Examination of the sputum made at 8:00 a. m., 4:00 p. m. and 8:00 p. m. showed no acid-fast organism, but indicated the presence of nonhemolytic Staphylococcus aureus, Neisseria catarrhalis and hemolytic streptococcus. Both culture and guinea pig inoculation for tubercle bacilli gave negative results. Papanicolaou stains disclosed no pathologic cells.

Special Studies.—The report on the roentgenogram of the chest was as follows: "The chest is essentially clear and is hyperaerated in both bases. The entire bronchovascular pattern suggests emphysema, possibly asthma and bronchitis. There is a suggestion of a possible cylindric bronchiectasis of minor degree. The diaphragms are flattened, a frequent finding in emphysema.

Bronchoscopy was performed on May 17. At the lower end of the trachea a growth occupied and encroached on one third of the lumen. The end of the growth was about 6 cm. above the carina and extended upward about 2 cm. Some of the exudate on the surface of the lesion was aspirated into a trap and subjected to Papanicolaou study. A small piece was removed with a cup forceps for histologic examination.

The Papanicolaou smear was reported as showing no cancer cells.

The biopsy report was as follows (figure): "Section reveals fragments of a stratified squamous epithelium, which lines a structure densely infiltrated with plasmacytes (plasma cells) and which forms a papillary architecture. The squamous epothelial layer is thickened, and transition can be seen between pale-staining, vesicular cells overlying a basement layer composed of regular, columnar cells to cells of hyperchromatic staining properties with variation in size and shape. Numerous mitotic figures are seen among them. The stroma is highly vascular. Diagnosis: Carcinoma, squamous cell."

The patient was advised to have electrosurgery via the bronchoscope, followed by irradiation. He was also informed that his might be a favorable case for surgical excision by the technic recently developed at the Mayo Clinic, in which repair of the excised trachea is performed over a plastic tube. He decided to return to his home in Virginia and consult with his family as to what course he should follow. He has not been heard from since.

COMMENT

It is apparent from the review of the literature that primary carcinoma of the trachea is rarely, if ever, considered as a possibility when the physician is confronted by increasing dyspnea and wheezing in an elderly patient. The condition usually masquerades as and is misdiagnosed and treated as asthma. Our experience, as well as that revealed by a study of the literature, indicates that little reliance can be placed on either roentgenologic examination of the chest or Papanicolaou studies of the sputum in cases of tracheal cancerous growth. It is significant, so far as Papanicolaou studies are concerned, that in this case no cancer cells were demonstrated, not only in repeated samples of sputum but in the exudate removed directly from the surface of the growth.

A positive diagnosis can be made only by bronchoscopic examination and removal of a portion of the growth for biopsy.

30 North Michigan Avenue.

PSYCHOSOMATIC ASPECTS OF SURGICAL TREATMENT OF OTOSCLEROSIS

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IN TWO previous papers [1] I discussed the development of personality and the psychodynamics of personality as they create psychosomatic disease and affect somatic disease in the field of otolaryngology. The purpose of this paper is to discuss the field of otosclerosis surgery in its psychologic aspects, with the hope of furthering understanding of some of the patients.

The problem of deafness has long been studied from the psychologic viewpoint. Hysterical deafness and malingering were among the diseases in which awareness of the psychologic relationship existed early. Our language expresses this in the common phrase "he turned a deaf ear." Also, many physicians and the hearing societies have long concerned themselves with the problem of social inadequacy resulting from organic deafness.[2] In a recent and outstanding article on the emotional aspects of hearing, Knapp [3] has discussed some problems of this field. Since the monumental work of Julius Lempert in perfecting for the first time a successful one stage fenestration operation for otosclerosis, a new hope has been offered for practical hearing to a substantial group of suitably selected patients with otosclerosis. Since 1938 I have been associated with this work and have had the opportunity of observing a large number of patients operated on by others and by me. One problem encountered during the course of these observations is the elimination of psychologic conditions which simulate otosclerosis. Another, and commoner, problem is the preoperative and postoperative management, particularly the patient-surgeon discussions, and its affect on the deafened personality in the course of treatment.

Presented as a candidate's thesis to the Chicago Laryngological and Otological Society, 1948.

1. Henner, R.: Psychosomatic Components of Diseases in Otolaryngology, Arch. Otolaryng. **47**:789 (June) 1948; read before the Cleveland Otological Society, December 1947.

2. Berry, G.: Psychology of Progressive Deafness, J. A. M. A. **101**:1599 (Nov. 18) 1933. Day, K. M.: Psychology of Deafness, Pennsylvania M. J. **40**:177, 1930. Menninger, K.: Mental Effects of Deafness, Psychoanalyt. Rev. **11**:144, 1940.

3. Knapp, P. H.: Emotional Aspects of Hearing Loss, Psychosom. Med. **10**:203, 1948.

Among the psychologic problems which may be confused with otosclerosis are the hysterias. Hysterical patients may vary only slightly from time to time audiometrically, contrary to the prevailing opinion that in psychogenic deafness there are varying results on testing. This opinion is due to the confusing of neurosis with conscious malingering. While a whole battery of tests has been devised to determine the so-called psychogenic overlays, they all depend on subjective findings and the clinical evaluation still remains the most important feature. Psychogalvanic tests and electroencephalograms may eventually prove valuable in determining whether or not sound impulses are being conducted centrally through an intact hearing mechanism. Certainly, any patient who shows an unusual degree of variation in hearing tests or who shows either anxiety or an excessively placid adjustment to his hearing loss should be investigated psychologically. Knapp [3] discussed a case of otosclerosis at the Deshon General Hospital with psychogenic exaggeration of the hearing loss. He pointed out that psychiatric treatment reduced the patient's hearing loss from 45 to 26 decibels. The diagnosis was confirmed by every test, including noise-voice, speech and psychogalvanic testing. He stated "It is perhaps enough to mention that if improvement, such as was obtained by psychotherapy, had been gotten after a fenestration operation, the result would have been regarded as a surgical success."

It would then seem advisable to have some standards for objectively evaluating personality prior to fenestration (or, for that matter, any elective surgical procedure). With this evaluation, diagnosis may be questioned or substantiated, exaggeration of symptoms may be exposed, and the adaptive capacity of the patient may be studied in order to determine his ability to go through treatment and face success or failure.

Among the conditions causing difficulty in diagnosis of otosclerosis are the hysterias and the prepsychoses. Patients with either of these may show good bone conduction and reserve cochlear function. I have tried to understand why certain patients with psychogenic deafness have good bone conduction and others appear to have nerve deafness. Thus far I have been unable to determine any differences except that the hysterical patient more frequently offers the picture of good bone conduction in the higher intelligence groups. This is probably true because the air conduction loss alone suffices to express the conflict. A conversion symptom performs two functions. It gratifies a wish contrary to the person's standards and ideals, and punishes for the gratification. For example, in the Army, some radio operators developed hysterical deafness in response to the fear of combat flying. The symptom expressed the conflict between the desire to do one's duty and the fear associated with the duty. Therefore, the deafness is a punishment and yet makes the radio duty impossible to perform.

The following cases demonstrate instances of hysteria which can be confused with otosclerosis.

CASE 1.—M. O., aged 33, was seen with a history of progressive hearing loss, worse in the past few years, with no apparent cause of onset. It was gradually progressive and made worse by head colds. Tinnitus was worse in the left ear and described as a pounding with a loud echo and increased by exercise, and there had been occasional mild vertigo in the past two years. The patient had had histamine treatment by another otologist and was referred for possible fenestration. The family history was noncontributory. Aural examination showed hearing for whispered voice at 1 foot (30 cm.) and for spoken voice at 2 feet (60 cm.) in the right ear and at contact in the left ear. In the Weber test the response was to the left. The result of the Rinne was markedly negative. The aural examination showed normal ears and patent eustachian tubes. The diagnosis of otosclerosis was confirmed, but in describing the pitch of the tinnitus during the audiometric examination the patient exhibited fine pitch discrimination not ordinarily in keeping with his occupation as a steel worker. I asked him whether he was interested in music, and he began to stutter about his cultural and esthetic interests. I asked him when the stuttering had begun and he revealed the following history, not previously related: He was the oldest of a family of four boys, whose father was a Ukrainian immigrant who at times was quite brutal. In one of his fits of brutality he threw the patient against the wall. The patient was 6 years old at the time and now has no memory of the incident, but his mother told him that he collapsed and had some bleeding from his nose. From this time on he stuttered and had poor hearing. His father left home a few years later and has not been heard of since. Since the patient was the oldest boy, he went to work at the age of 12 and has helped support the family since then. He stated that he left high school in his third year because, rather than expose his stuttering, he refused to recite in class. He was suspected of copying and plagiarism because of the excellent written work and comparatively poor oral classwork. In the intervening years he worked steadily as a steel worker. He had been married three times and was contemplating a fourth marriage. The patient was referred to a psychiatrist, who corroborated the impression that the deafness and stammering were on a hysterical basis and recommended psychotherapy. The psychiatrist pointed out that in the course of his discussions with the patient the left ear lobe became quite flushed, as compared to the normal pallor of the right lobe, and that he had come to the interview without his hearing aid. (I have seen an instance in which hysteria caused a Raynaud-like attack with pain, blanching and subsequent flushing in the concha. It is conceivable that these stigmas of vasomotor changes may affect the cochlear and vestibular mechanism as well.) I advised against fenestration because of the fact that the diagnosis of otosclerosis was now suspect and because of the severity of the patient's neurotic problems.

CASE 2.—E. M., a 22 year old WAVE, had undergone fenestration in another city and was referred to me for after-care. The postoperative cavity was well healed, and the fistula test produced an active response. The ear was fenestrated primarily for the tinnitus and secondarily for poor hearing, since the opposite ear was normal. Postoperatively, however, the patient had to quit work on account of poor hearing, in spite of the normal untreated ear. Hearing examination of the fenestrated right ear showed only an island of hearing at the 512, 1024, 2048 and 4096 frequencies at 80 decibels, and bone conduction hearing for those frequencies was 25, 35, 70 and 70 decibels, an unusual curve, even for a postoperatively injured labyrinth. In discussing some of the conditions leading up to her ear complaints, the patient told me

of her love for a marine who was killed in action and of the subsequent development of tinnitus and inconstant periods of hearing loss which were relieved by reassignment while she was in service but which finally became progressive. Her attention was brought to the psychologic aspects of her severe depreciation of hearing postoperatively, and she was given an explanation of the displacement of personal conflict and hostilities to the ear so that her own life was disturbed and she was unable to hear enough to work in spite of a normal-hearing ear. She disclaimed all psychologic associations vehemently and disclaimed further any feeling that the operation had reduced her employability. She then asked whether she could work as an airline hostess. I replied that she could fly anywhere but that I doubted that an airline would hire a hostess who had had recent fenestration. She said, "You see!" I immediately ask her what she meant, and she retracted all her previous denial of using the operative failure to avoid going back to work. At this point psychotherapy was advised, and she was referred to the Veteran's Rehabilitation Center.

This case is discussed both as a hearing problem and as an instance of listening to a patient's story, for patients usually find ways to tell what is really troubling them. It is the feeling of most surgeons that in cases of unilateral deafness operation should not be done. This patient's history made the diagnosis of otosclerosis suspect, and surgery was detrimental.

Another type of case which is apparently rather familiar to psychiatrists and generally overlooked by otologists is the prepsychotic hearing defect. An experienced analyst,[4] in a personal communication, has called my attention to his experience with a large number of schizophrenic patients. He stated that auditory hallucinations are often preceded in the prepsychotic phase by "negative hallucinations." These consist in tinnitus and deafness as a protective mechanism against conflict which may last over a period of years. When this and other mechanisms fail and the person actually becomes psychotic, the tinnitus changes into actual auditory hallucinations and the hearing returns. The following cases are examples of prepsychotic deafness:

Case 3.—H. P., a white man aged 55, was referred for deafness, tinnitus and possible fenestration. He had had treatment at a clinic over a period of years with inflations, vitamins, leeches to the mastoid and, finally, operation on an antrum for a questionable solitary polyp. Relief was not obtained. He then consulted an otologist, who performed a Lempert tympanosympathectomy. Before this operation his tinnitus consisted in intermittent buzzing and crackling that was extremely disturbing. After the sympathectomy, a constant hum appeared and an increase in hearing loss occurred. Examination of the ears, nose and throat revealed nothing significant except evidences in the right ear canal of a healed sympathectomy scar. Audiometric studies showed a constant hearing loss of 70 per cent by air. Bone conduction hearing at the 512, 1024 and 2048 frequencies was 10, 15 and 25 decibels. The hearing loss in the left ear was just below the 30 decibel level. On the second

4. Blitzsten, N. L.: Personal communication to the author.

5. English, R.: I Can Hear Again, Sat. Eve. Post **218**:18, 1946.

visit the patient said his tinnitus was as if two electric wires were in poor connection and were setting off shocks and crackles that spread across his head. This, together with exhaustive therapies and the obvious anxious facies out of proportion to the symptoms, suggested a psychologic difficulty. Phonograph conversational voice was presented with spondaic words binaurally at 30 decibels. When a malingering test box was used, the switch was intermittently placed on the right ear and the patient continued to repeat the words. The results of the Lombard test were also inconsistent. They pointed to a near conscious suppression of hearing in the affected ear, not apparent with the pure tone audiometer. The patient was referred for psychiatric study.

It was found in one interview that his unhappy marital relations and home life were related to his hearing loss and tinnitus. When things were tense and intolerable, his tinnitus was aggravated, and when the psychiatrist was interviewing the patient he was free from all difficulty. He was referred to a psychiatrist for this investigation because his attitudes and description of electrical shocks suggested a near psychosis, and inexpert probings could easily have blown up an acute reaction. All he wanted was some one to listen to how he would like things, something he could not get at home.

Tinnitus and hearing losses may be part of the defense against psychosis. In such patients the precipitation of a psychosis may result in the restoration of hearing and active auditory hallucinations. Needless to say, a great deal of care must be used in the management of such cases. It is important to note that, on three separate occasions during the interview in case 3, the patient reiterated his freedom from tinnitus while talking to the psychiatrist. Patients often tell their physicians things that would have tremendous significance, if the latter would only listen. The psychiatric referral in this instance, in view of the improbability of curing the patient otologically, may have acted to prevent a complete breakdown. Such a breakdown could well have occurred if an otologic opinion of incurable tinnitus had been given. At the same time by audiometric and otologic standards a diagnosis of otosclerosis could have been made.

Case 4.—R. F., a 35 year old woman, presented herself with a history of bilateral hearing loss since the age of 15, tinnitus, and gradual progressive loss of hearing for the past twelve years. The family history was noncontributory. The tinnitus was described as being of moderate intensity and not too severe. The patient gave a history of one or two attacks of vertigo yearly and of acute unilateral otitis media at the age of 10 years. Whispered voice was not heard in the right ear, and spoken voice was heard at 3 feet (0.9 meter); in the left ear hearing for whispered voice was 6 inches (15 cm.) and for spoken voice, 4 feet (1.2 meters). Tuning fork and audiometer tests showed a typical bilateral nerve degeneration. Because of the good hearing for the lower tones, the patient was told that a hearing aid would be difficult to wear. However, she chose to purchase a hearing aid and she was given advice as to the auditory training with her hearing aid. Nine months later she returned with the complaint that hearing in her left ear had become worse and that she had experienced some disappointment in the use of her hearing aid but had continued to wear it. The character of the tinnitus had changed to a chirping

noise in both ears, with that in the right ear more severe. She stated that at times the noises disappeared entirely. She had increasing fatigue and sensitivity of the nasal passages. Three days prior to this visit she had become panic stricken with the feeling of drainage in the right ear. Hearing tests at this time failed to reveal any progress in the loss of hearing.

Since the patient gave the impression of a severe depression out of proportion and not completely attributable to her hearing problems, and because of the character of the tinnitus and the incident of panic, she was advised to consult a psychiatrist. She then told me that she was already under the care of a psychiatrist, and I received her permission to discuss the case with him. Her psychiatrist stated that she had been under treatment at a state hospital for schizophrenia. After treatment she had improved but at present was again becoming depressed. He had advised her to return to the hospital for further treatment and further stated that he felt the tinnitus was closely related to her hallucinations or was a manifestation thereof. From this history it seems likely that the symptoms referable to the ears were part of a psychic picture. It is interesting to note that in her panic experience the patient thought that she had a discharge from her right ear which could not be substantiated by observation. It seems also likely that some of her present difficulty may refer back to some of the experiences that she may have had at the age of 10 years with an otitis media.

Descriptions of changes in the character of the tinnitus should be listened for. One must be suspicious of the change of a hiss or whistling sound into what some patients describe as electric shocks or two wires crackling as if there was a bad connection between them. It will be noted that the first of the psychotic patients might be considered a fit subject for the fenestration operation while the second patient would clinically be considered to have nerve deafness. While the deafness in the second case might be considered as an independent finding, still it was the character of the tinnitus with the facies of depression which leads one to suspect that the otologic picture was either secondary or relatively unimportant compared with the need for psychiatric care. Such patients may also simulate the picture of otosclerosis.

So much for the problems of diagnosis. The "normal" patient who undergoes fenestration should now be considered.

The previously mentioned psychoanalyst stated further that in his observation of fenestration patients, those who had been analyzed showed a much higher percentage of favorable results psychologically than the emotionally immature and maladjusted patients who had not been analyzed. Such an opinion is probably based on the fact that a person with loss of conversational hearing can be looked on as one who has lost an important aid to his adaptive capacities. Most patients respond to hearing loss with personality changes that use the technic of retreat and introspective seclusion; they defend themselves from the challenge of society by building a wall around themselves. Others overcompensate for this hearing loss and strive for success despite their handicap. Those patients who have made little attempt at compensation for their

reduced adaptive capacities immediately display the deep-seated human tendency to resort to magic and omnipotent powers when they hear of the fenestration operation. Probably the factor that in large part always protected them against complete depression was the feeling that somewhere, somehow, through some magical influence their hearing would be restored. Such patients consult the fenestration surgeon and, regardless of what he says as to their opportunity for success and as to the type of hearing to be expected, they believe only what they want to believe. Such patients expect not only that hearing will be restored but also that all social problems will be solved. Love, affection, security and success await them with the restoration of hearing. Failure is now impossible. In contrast, mature persons, after weighing and evaluating the probability, the type and the degree of hearing which may be gained, submit themselves to the operation with full realization of their situation. The result is a higher percentage of practical and adequate hearing and satisfaction with the result. On the other hand, in unstable persons one may even see evidences of temporary improvements, sometimes even in the untreated ear, and this may be substantiated by zealous testing audiometrically. However, such successes are shortlived, and, sooner or later, severe depression associated with the failure ensues. Thus it may be that successfully analyzed people who submit to the operation are in a better position to use the resulting hearing gain and be satisfied with the limitations of that improvement because their original attitude was realistic, while unstable people wishfully hear what they want to hear relative to the percentage of success and the degree of hearing to be expected in a successful case. At the same time the surgeon, out of his impulse to perform more operations, may color his language, often unconsciously, in such a way as to enhance the magic the patient is seeking. All patients go through various psychologic phases preoperatively and postoperatively. I have discussed these in a previous article [1] as follows:

> In fenestration surgery for otosclerosis one finds an outstanding example of relevant psychic factors. All are familiar with the introspective seclusive personality of the deafened, who retreat from social intercourse because they so keenly sense their adaptive inadequacy. On hearing of the operation for the first time, the patient reacts with hopeful expectation and becomes guardedly enthusiastic. He sees again the possibility of personal adequacy and security. After undergoing the surgical treatment he lives in trepidation, and yet, at the same time, is hopeful and anxious regarding the outcome. Then for the first time in years he hears. The mood becomes progressively elevated until at times one appears to be dealing with a maniac. The surgeon is idealized, the discomfort of treatment becomes negligible, and the hope for the future is bright. The critical period of evaluating the result, approximately six months to a year, passes, and in successful cases there is restored to society a useful citizen, full of hope, creative energy, expectancy and self assurance. However, should the result of the operation then fail in a patient inadequately prepared

psychologically for such an operation, one may see a depression which may result in further crippling of the personality, occasionally so severe as to involve suicidal tendencies.

These are the normal variations when a surgeon is affecting such crucial variables in personality. The devastating effects are all multiplied and enhanced by poor and improper preoperative discussions and promises in the event of later failure.

No attempt will be made to discuss the cases in which improper preoperative promises were made. Most otologists are familiar with this problem. The following cases illustrate poorly timed and psychologically poorly prepared patients.

Case 5.—D. B., a married woman aged 37, was referred for poor hearing since the age of 10 years. Paracusis Willisi was absent, but the patient had moderately severe ringing tinnitus. She had worn a hearing aid for two years. Hearing for whispered voice in the right ear was absent, and spoken voice was heard at 6 inches (15 cm.). In the left ear the whispered voice was heard at contact; spoken voice, at 1 foot. The Weber response did not lateralize; the Rinne result was markedly negative. The eustachian tubes were patent. The patient was advised that she was suitable for fenestration. Several days before operation she presented herself for the final hearing test. She stated that she was now in shape for the surgery, since she had just got her final divorce papers. The operation was uneventful and successful. However, despite audiometric improvement to below the 30 decibel level, she continued to wear her hearing aid. She was asked why she wore her hearing aid and she stated that she did not "trust" her treated ear. We discussed the situation of the discrepancy between the audiometric test and her need for the aid. In the course of the conversation she admitted that she was worried about hearing well because her recovery would necessitate going to work and leaving her children. In her visits for postoperative dressings she was usually accompanied by her 5 year old son, who began to show increasing signs of tension, anxiety and tremors. The mother stated that the boy had been having severe nightmares lately. He was referred to the Institute of Juvenile Research for psychotherapy. When the correlation of a poor hearing result to her personal problems was demonstrated, she immediately gained practical conversational hearing to 20 feet (6.1 meters), in keeping with her audiometric gain. She has maintained this hearing for the past year and a half.

The operation in this case probably should have been postponed past the period of adjustment after the divorce for both the patient and the child.

Case 6.—M. M., a woman aged 42, had fenestration on the right for otosclerosis in October 1946. Her postoperative vertigo and vomiting were severe, and for nine days she required constant sedation and intravenous feedings. I was afraid that I had unduly traumatized the labyrinth. I observed that the patient was a divorcée, separated from her family, and the occasion of her illness had brought them all up from Missouri to visit her. Because the spontaneous nystagmus had subsided in forty-eight hours, I felt that the continued illness beyond the usual postoperative period was in some part an attention-getting device. On this basis the patient was forcibly told that she would get no more intravenous feedings and that unless she ate her meals I would not be responsible. That night the patient ate her supper and completely discontinued her vertigo and vomiting. Her hearing result was only

partially successful and her improvement below the practical level. She agreed to fenestration of the other ear, and we discussed the psychologic basis for her vertigo and vomiting.

I recently performed fenestration on the left and on the second postoperative day a forceful reminder was required to stop an attempt at vomiting. No further symptoms occurred. The removal of her packs and her discharge from the hospital were delayed by an illness of my own. When I finally came to remove her packs, her interesting observation was, "Doctor, when you got the flu did you go home to your wife for some attention?" This statement reveals her appreciation of the psychologic nature of her vomiting.

This case is presented because I feel that the first operation may have been more successful had I appreciated the psychologic nature of the vomiting earlier. Such patients have specific expressions of their problems in their postoperative course. In order to clarify the psychologic position of the otologic surgeon in fenestration and to avoid such difficulties, I have formulated the following suggestions for preoperative discussions.

1. No unusual promises should be made as to the degree of success or percentage of success within the actual limits of the operator. To promise 90 to 100 per cent results has a devastating effect on the subsequent failures. The criterion of 60 per cent successes with two years of practical hearing is high for most operators.

2. The fact that the patient regains practical hearing but not completely normal hearing for whispered voice should not be minimized.

3. Mild yet annoying complications, such as postoperative vertigo, may occur and often last beyond twenty-four to seventy-two hours. The unsteadiness may last for several weeks to months in almost half the cases. Most patients have momentary dizziness on sudden movement or sneezing even years postoperatively.

4. In general, a simple explanation in lay terms of what is to be done and why, yet without instilling fear, is the best approach. Most patients can approach tedious, painful and discomforting surgical treatments when they have an understanding of what they face and what to expect. If they cannot face it they drop out voluntarily; if suspected, they should be surveyed psychiatrically.

5. The type of anesthetic and character of the incision for the operation should be pointed out. For some patients, a complete description of the surgical procedure is necessary. A common complaint of the patients who have been operated on by extremely busy fenestration surgeons is that in the weeks of contact with the surgeon they never were told anything except possibly that everything was going well.

6. An attempt should be made to rule out patients with hysterias, prepsychoses and other mental instabilities that may affect the hearing.

In addition to the preoperative knowledge imparted to the patient, the surgeon should make an attempt to learn something about the patient during this discussion. Because the article "I Can Hear Again," by Richard English,[4] verbalizes many of the common feelings of the fenestration patients, otologists would do well to read it with care. While it would be time-consuming to gather from each individual patient all the material he presents, the psychologically aware surgeon may learn much about the patient's personality by just listening and not asking questions. Variations of the answers to the following questions should be listened for with care.

1. What is the reason for surgical intervention? A common answer is social rehabilitation, professional duties or even the chance to hear one's child's voice again. Other reasons may arouse suspicion worth investigating.

2. Has the patient philosophically evaluated his chances for failure, his chances for remaining the same and his chances for getting worse and then assumed the risk?

3. Has he understood the degree and type of hearing to be restored, and will it fulfil his needs in terms of his particular reason for the operation?

4. Will the placing of an artificial time limit for evaluating the result cause undue concern or act as a necessary brake on overenthusiasm with the result?

5. Before the knowledge of the fenestration operation did the patient have fantasies of the return of his hearing?

6. Did he ever try a hearing aid? The patient who is ashamed to wear a hearing aid and has never tried one is often a poorer candidate than one who is disappointed by the discomfort produced by the aid.

7. Was the patient on a social and professional level adjusted to his hearing loss, and with the increase in loss did his personality change markedly?

8. Was the patient ever severely depressed, particularly over his hearing loss?

These questions should offer a background for evaluating the patient in regard to his hearing loss and his responses to surgery. Others may occur with the individual patients.

SUMMARY AND CONCLUSIONS

Some psychologic aspects of fenestration surgery are presented. The problems of those patients with psychiatric disorders which can be confused with otosclerosis and the selection and the psychic preparation for surgery are stressed.

As with all elective and functional surgery, operation in cases of otosclerosis which may result in serious psychic problems should be avoided. Prediction of such breakdowns preoperatively is difficult. Certainly the preoperative and postoperative management should provide for a minimum of those factors which operate to precipitate breakdowns. Knowledge of these factors can operate to minimize the difficulties with surgical treatment of otosclerosis. However, knowledge cannot replace a warm relationship and a helpful appreciation of the patient's problems by the surgeon.

UNUSUAL NASAL TUMORS

Report of Two Cases

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IT IS THE purpose of this report to present two rare tumors of the nasal cavity, with a review of the literature. Case 1 concerns a cystic basal cell carcinoma of the middle turbinate body. Case 2 concerns an adenocarcinoma arising from the same site. During the process of this review, there was found to be a great lack of uniformity in terminology. Thus, the same type of tumor is called cylindroma, adenoma, endothelioma, mixed salivary gland tumor, cystic basal cell carcinoma, adenosarcoma or adenocarcinoma, by both foreign and domestic writers. An attempt at clarifying these terms is made.

EMBRYOLOGY OF THE NASAL CAVITY

The lining mucosa of the nasal cavity and paranasal sinuses is formed from the invaginating ectoderm of the olfactory plates at the end of the fourth week of embryonic life. It is continuous posteriorly with the mucosa of the nasopharynx, which is entodermal in origin but of similar histologic structure.

At first these olfactory plates are in contact with the cerebral vessels, but later the meninges and ethmoid bone separate them from the brain. Outgrowths of the nasal lining in the third month form the middle meatus, and further extensions at the posterior end form the pockets for the maxillary sinus. From the anterior portion four furrows develop, two representing buds for the frontal sinuses, and the remainder giving rise to the ethmoid air cells. The lining membrane differentiates to form pseudostratified ciliated columnar epithelium, resembling the respiratory epithelium of the lower pulmonary passages. Undifferentiated cells in the basal layer give rise to the mucous glands of Bowman. The submucous tissue of this region is particularly rich in mucous glands and in blood vessels.

CYSTIC BASAL CELL CARCINOMA

CASE 1.—*History.*—A white woman aged 57 complained of progressive unilateral nasal obstruction. The obstruction was found to be due to a smooth, nodular thickening of the left middle turbinate body. The turbinate was resected in part. At operation the tissues were found to be soft and friable and unduly hemorrhagic.

Pathologic Findings.—Gross: The specimen consisted of several irregular fragments of soft tissue measuring up to 4 mm. in greatest dimension. Also present were several fragments of thin bone.

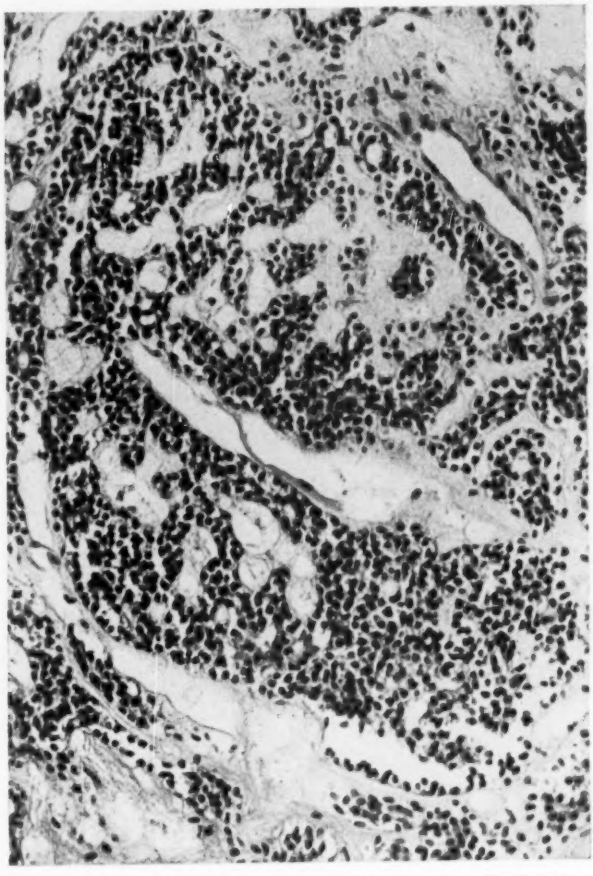

Fig. 1.—Adenocystic basal cell carcinoma of nasal cavity. Hyalinized stroma and mucinous degeneration are evident.

Microscopic: Sections of tissue revealed numerous small fragments. These were covered in part by pseudostratified, ciliated, columnar epithelium, which in some zones was eroded and replaced by granulation tissue. Beneath the epithelium was a neoplastic process composed of isolated and confluent nests of polyhedral epithelial cells. Many of the cell nests had central spaces filled with a pale,

eosinophilic, homogenous material. The cells had dark, pleomorphic, hyperchromatic nuclei and small amounts of cytoplasm. Mitotic figures were present. There appeared to be a tendency for the cells surrounding the cystic spaces to be rounded, while those at the periphery were cylindric. Invading the tumor and surrounding

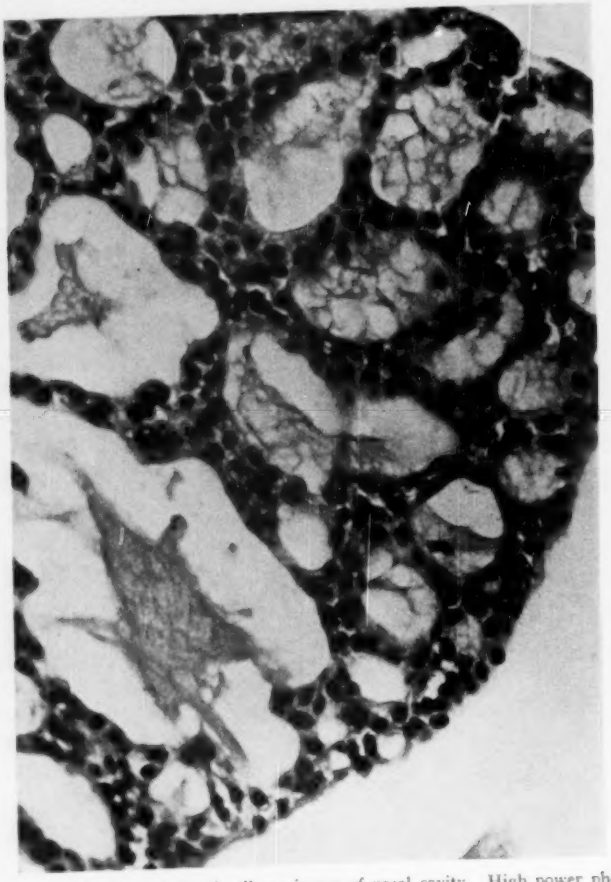

Fig. 2.—Adenocystic basal cell carcinoma of nasal cavity. High power photomicrograph showing typical cylinder formation.

the cell nests was a connective tissue stroma composed largely of hyalinized fibrous tissue. There were scattered areas of myxomatous or mucoid degeneration in the connective tissue. The neoplastic tissue extended up to the lines of excision.

Diagnosis.—The diagnosis was adenocystic basal cell carcinoma of the nasal cavity.

The patient was observed during office visits over a six month period. There was clinical evidence of local recurrence. However, the patient refused further operation or biopsy.

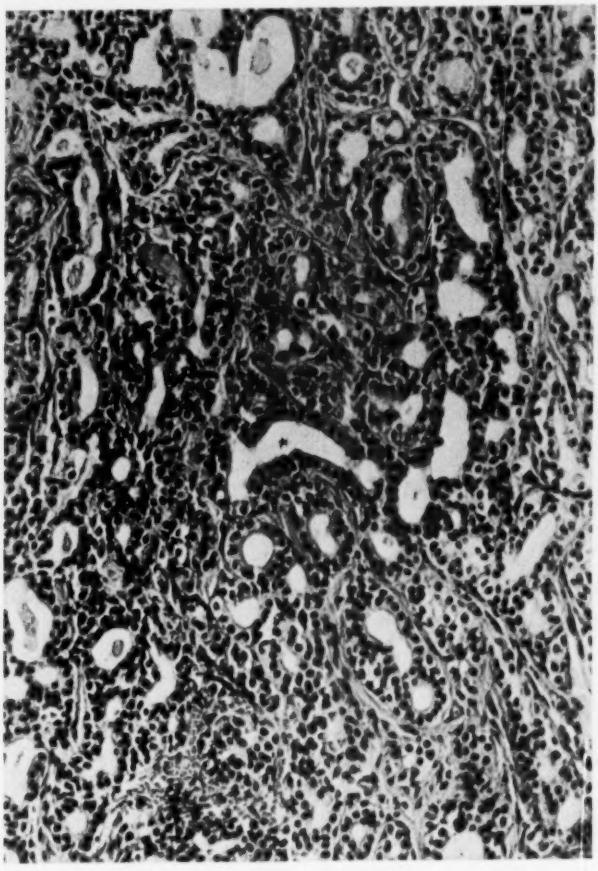

Fig. 3.—Adenocystic basal cell carcinoma of nasal cavity. Note nests of dark basal cells forming cylinders and solid balls of cells. The connective tissue stroma is evident. Low power magnification.

Review of Literature.—Billroth,[1] in the 1850's described a tumor of the orbit which was characterized by nests of what he considered to be epithelial cells. Each nest was surrounded by a sharply defined ring of hyalinized connective tissue which

1. Billroth: Untersuchungen über die Entwicklung der Speicheldrusen, Virchows Arch. f. path. Anat. **17**:359, 1859.

appeared to be separate from the stroma and from the tumor cells. In some instances these nests contained a similar hyaline core. He expressed the opinion that this hyaline material was derived from the connective tissue as a result of degenerative changes and coined the term "cylindroma" for this particular histologic

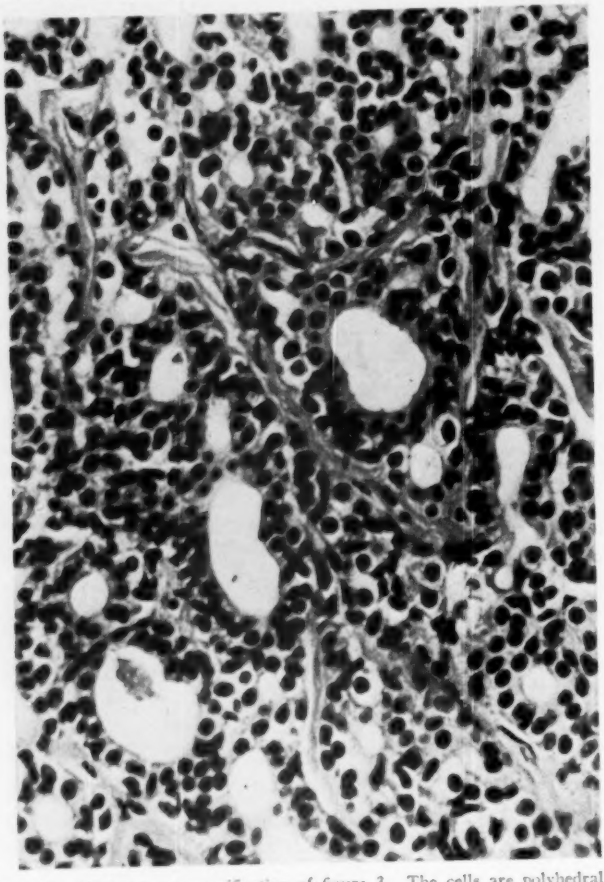

Fig. 4.—High power magnification of figure 3. The cells are polyhedral and pleomorphic; hyperchromatic nuclei are well shown.

picture. Since this original description many tumors have been called cylindromas. Most of these tumors differ greatly from, others are identical with, the original description.

Kolaczek,[2] in 1878, stated that he believed so firmly in the endothelial origin that he suggested the substitution of "angiosarcoma" for cylindroma.

2. Kolaczek, J.: Ueber das Angiosarkom, Deutsche Ztschr. f. Chir. **9**:1, 1878.

Volkmann[3] expressed the belief that these tumors were of endothelial origin, probably derived from blood vessels or lymph channels.

Pfeiffer,[4] in 1913, reported 2 cases of tumors which he called cylindromas. The histologic picture was characterized by circumscribed cords of epithelial cells and hyaline material. He considered these tumors to be derived from endothelium.

Barbezet,[5] in 1917, reviewed the literature and found it very scanty. He described a case in which the right side of the face and orbit were involved. The patient died as a result of extension of the tumor to the brain. Microscopically, he described the tumor as being made up of isolated and confluent nests of polyhedral epithelial cells of moderate size, being well stained, with round nuclei and a moderate amount of cytoplasm. Some of the cell nests had central spaces containing pink-staining homogenous material. The author stated the opinion that the tumor was epithelial, originating in the mucous membrane of the nasal or paranasal cavities.

Ferreri,[6] in 1928, reported 3 cases of cylindroma. His description included nothing on hyaline cylinders, but there were spaces surrounded by what he considered to be endothelial cells. Some of the spaces were cystic and contained hyaline material; others were filled with cellular debris. He considered these tumors to be of endothelial origin without giving any reasons or proof for this concept.

Davies,[7] in 1928, reported a case of a tumor of the scalp, composed of epithelial cords without surrounding hyaline material. He was the first to put forth the idea that the entire group of so-called cylindroma was merely a type of basal cell carcinoma.

Eigler,[8] in 1932, collected 4 cases of cylindroma which presented a similar histologic picture. However, none of these were in the nasal cavity. One was found at the base of the tongue, 1 in the larynx and 2 on the palate.

Stillians,[9] in 1933, reported a case of cylindroma, concluding that cylindromas originating from surface epithelium or hair follicle are basal cell epitheliomas. He agreed with Hoffman that these growths should be called "nevoepithelioma adenoides."

Ironically enough, it was back in 1918 when Krompecher[10] did his classic work on basal cell carcinomas. Apparently, the investigators working on this

3. Volkmann, R.: Ueber endotheliale Geschwuelste, Deutsche Ztschr. f. Chir. **41**:1, 1895.

4. Pfeiffer, W.: Ueber die "Cylindrome" der oberen Luftwege, Arch. f. Laryngol. u. Rhinol. **27**:516, 1913.

5. Barbezet, C.: Ueber Cylindrome, Virchows Arch. f. path. Anat. **223**:242, 1917.

6. Ferreri, G.: Contribution à l'étude clinique et anatomo-pathologique due cylindrome due maxillaire supérieur, Acta oto-laryng. **12**:411, 1928.

7. Davies, J. H. T.: A Contribution to the Histology of the Cylindromatous Tumours of the Scalp, Brit. J. Dermat. **40**:241 (June) 1928.

8. Eigler, G.: Ueber Endotheliome, Peritheliome, Cylindrome und ähnliche Tumoren der oberen Luftwege, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **132**:209, 1932.

9. Stillians, A. W.: Nevo-Epithelioma Adenoides (Cylindroma) of the Scalp, Arch. Dermat. & Syph. **27**:481 (March) 1933.

10. Krompecher, E.: Zur Kenntnis der Basalzellenkrebse der Nase, der Nebenhöhlen, des Kehlkopfes und der Trachea, Arch. f. Laryng. u. Rhin. **31**:433, 1918; Ueber die Basalzellentumoren der Zylinder-epithelschleimhäute mit besonderer Berücksichtigung der "Karzinoide" des Darms, Beitr. z. path. Anat. u. z. allg. Path. **65**:79, 1919.

subject were unfamiliar with it, and, subsequently, so many blunders were made which could have been avoided. He placed cylindromas as a definite subgroup in the class of basal cell carcinomas. He sharply subdivided the group of basal cell carcinomas into the solid adenoid and the cystic types and commented on their histogenesis from the skin. He expressed the opinion that basal cell carcinomas of the mucous membranes were derived from the basal cells of columnar epithelium and emphasized the fact that in contrast to the basal cell carcinomas of the skin, which are generally of the solid type, the adenoid and cystic types predominate in the mucous membranes. He stated that the cylindromas of the nares are always derived from polyps. He concluded that this group of nasal tumors is relatively benign, rarely becoming malignant.

In later years, Ewing [11] supported Krompecher's [10] theories. He went further in the classification but added no new ideas.

In 1929, Kaufmann [12] discussed the wide variation of tissue architecture possible in basal cell carcinomas and theorized that the spaces frequently seen within the cords arise either from degenerating plugs of neoplastic cells or from the previous existence of hyaline or mucoid stroma in this part of the cord. He pointed out the cylindric appearance of the peripheral cells of the cords as contrasted with the rounded to polyhedral form they assume in the center.

In 1934, Bredlau [13] reviewed the literature and presented 1 case which is identical with the ones presented here. His was the first such case reported in the American literature. The term cylindroma was considered by him to be quite inappropriate except for those few that show the true characteristic features, namely, hyaline cylinders surrounding the individual cell nests with well defined central hyaline cores within the cell nests. Therefore, reserving the name cylindroma for the characteristic tumor described by Billroth,[1] the remainder should be classed as basal cell carcinomas of the mucous membrane and skin, the terms employed by Krompecher [10] to describe the varieties—solid, cystic and adenoid—being reserved for their finer classification.

In 1935, Geschickter [14] suggested a large and all-inclusive classification for nasal tumors. He compared the basal cell carcinomas to the aberrant salivary gland type of tumors and gave a short histologic description of this general type of tumor. He reported 15 cases accumulated from a study of more than 2,000 specimens in the department of laryngology and otology of the Johns Hopkins Hospital. Only 6 tumors were in the nasal cavity. He presented a history which is very typical of the cystic basal cell carcinoma in his series and illustrated the tendency to local recurrence.

ADENOCARCINOMA

Case 2.—*History.*—A white man aged 41 had a complete nasal obstruction of the left side several months prior to admission. The growth of the obstruction was slow, developing over a period of several years. A bilateral polypectomy had

11. Ewing, J.: Neoplastic Diseases: A Text-Book on Tumors, ed. 3, Philadelphia, W. B. Saunders Company, 1928, pp. 55 and 769.

12. Kaufmann, E.: Pathology for Students and Practitioners, translated by S. P. Reimann, Philadelphia, P. Blakiston's Son & Company, 1929.

13. Bredlau, E. A.: Recurrent Basal Cell Carcinoma of the Nasal Septum: Histogenesis of So-Called Cylindromas, Arch. Otolaryng. **20**:382 (Sept.) 1934.

14. Geschickter, C. F.: Tumors of the Nasal and Paranasal Cavities, Am. J. Cancer **24**:637 (July) 1935.

been performed five years before. Complete relief was expressed for two years. The patient was well developed, well nourished and in good general health. There was complete obstruction of the left nasal cavity by a pale, yellowish white growth, which bled easily. The results of the remainder of examinations and laboratory work were essentially within normal limits. With local anesthesia, a single mass

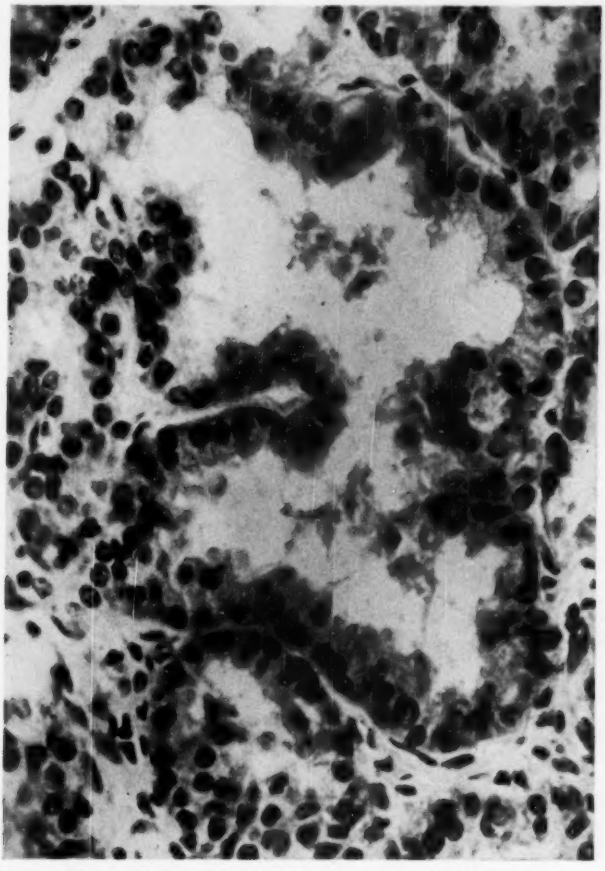

Fig. 5.—Adenocarcinoma of nasal cavity. Photomicrograph showing tall columnar cells lining the glands and alveolar structures. High power magnification.

of soft tissue measuring 3 by 2 cm. was removed. The removal was associated with a marked amount of hemorrhage.

Pathologic Report.—Gross: The specimen consisted of a single mass of soft tissue measuring 3 by 2 cm. It was pinkish white, soft and gelatinous. It was

covered by what appeared to be a shiny membrane. It was roughened at one end, where it was apparently detached. On section, it had a homogeneous appearance similar to that of the external surface.

Microscopic: Sections of tissue revealed a rounded polypoid mass, covered in part by a layer of pseudostratified, ciliated, columnar epithelium, which in some

Fig. 6.—Adenocarcinoma of nasal cavity. Photomicrograph showing the glands and acini containing varying amounts of mucin. The cells have a large amount of cytoplasm. The nuclei are large, hyperchromatic and anaplastic.

areas was replaced by a metaplastic type of squamous epithelium. On other areas the surface was eroded. The body of the tumor was composed largely of alveolar structures, filled with epithelial cells. The cells were tall and columnar, with a generous amount of clear-staining cytoplasm. The nuclei were large and hyper-

chromatic, and occasional mitotic figures were seen. Within the lumens of some of the acini were seen a varying amount of mucin. However, most of the glands had lost this mucin-producing property. In these instances, the cells lining the glands appeared more anaplastic and more hyperchromatic, and a greater ratio of mitotic figures was seen. The central portion of the tumor was occupied

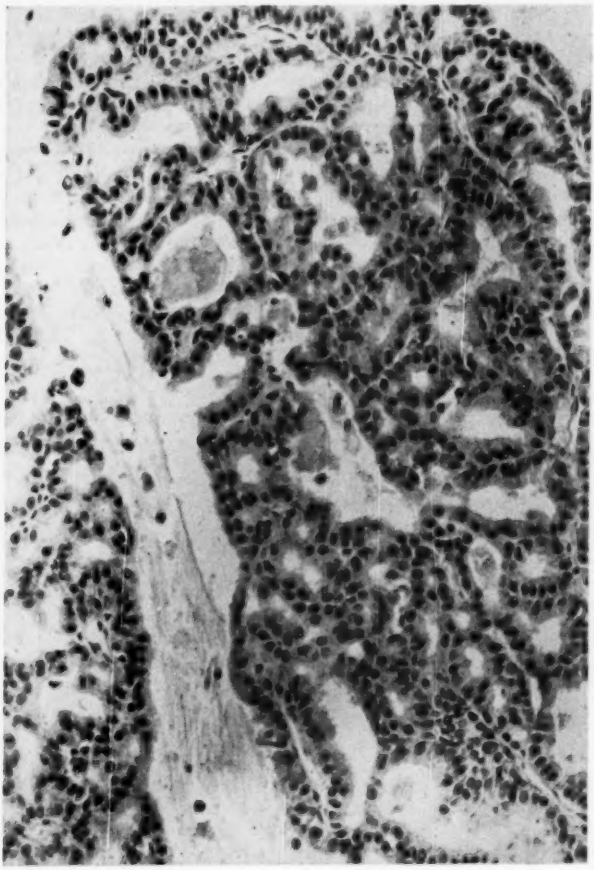

Fig. 7.—Adenocarcinoma of nasal cavity. Photomicrograph showing paucity of stroma and well defined gland formation. Neoplastic cells are noted invading the stalk.

by a thick stalk of connective tissue containing fair-sized blood vessels. Much of the connective tissue had become hyalinized. Seen invading the stalk were numerous small groups of epithelial cells, which, in some instances, formed fairly-

well defined glands. In other instances, the attempts at gland formation were abortive, resulting in a ball of anaplastic epithelial cells. In areas where the neoplasm appeared to be more active were seen numerous recently-formed fibroblasts, which from the size of their cytoplasm appeared to be quite active. Scattered throughout the tumor were seen occasional focal collections of lymphocytes. There were also a few lymphocytes and an occasional eosinophil scattered throughout the stroma.

Diagnosis.—The diagnosis was adenocarcinoma of mucous membrane of the nasal cavity.

The patient was readmitted two months later because of difficulty in breathing and visible recurrence at the operative site. This time, the turbinate bodies were cut with a scissors and removed with a snare. The ethmoid cells were punched out and curetted. Bleeding was profuse. More radical surgery was suggested but refused.

Review of Literature.—Adenocarcinoma is one of the rarest tumors of the nasal cavity. As such, there is a paucity of literature on this subject. Isolated cases in foreign and American literature are often referred to as adenomas or adenosarcomas. Because of this, an accurate determination of the number of reported cases of this type is impossible. Another obstacle is the fact that these reports seldom contain a histologic description of the tumor.

The earliest reliable case found was one by Mayer [15] in 1902. The tumor arose from the middle turbinate body, causing nasal obstruction and facial deformity. When removed, it weighed 117 Gm. Histologically, it was described as being "papilliform adenomatous tissue." There was some fibrous tissue and small round cell infiltration. There was thought to be in some areas a tendency toward sarcomatous degeneration.

Portmann and Retrouvey [16] in 1927 reviewed 120,000 cases of all kinds in the otorhinolaryngologic clinic at Bordeaux between the years 1885 to 1925. Of this number the growths in 1,039 were cancerous; 63 were in the nasal fossae, and only 2 could be considered adenocarcinoma.

Fraser [17] reported a case in 1928 of tumor that invaded the sinuses, palate and the pharynx. New [18] in his report stated that he found only 6 adenocarcinomas in a series of 91 cases. Fabricant [19] reported 1 in a series of 23 nasal tumors; Nash [20] reported none in a smaller series.

Beck [21] discussed the incidence of nasal tumors from a series of 579, reporting no adenocarcinoma, whereas Hill [22] found 2 adenocarcinomas in a series of 8 malignant tumors.

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15. Mayer, E.: Adenoma of the Nose, with Incipient Sarcomatous Metamorphosis, Tr. Am. Laryng. A., 1902, p. 80.

16. Portmann, G., and Retrouvey, H.: Le cancer du nez, des fosses nasales, des cavités accessoires et du nasopharynx, Paris, Gaston Doin, 1927.

17. Fraser, J. S.: J. Laryng. & Otol. **43**:156, 1928.

18. New, G. B.: Malignant Tumors of the Antrum of Highmore, Arch. Otolaryng. **4**:201 (Sept.) 1926.

19. Fabricant, N. D.: Incidence of Malignant Tumors of the Head and Neck: Statistical Survey, Arch. Otolaryng. **29**:65 (Jan.) 1939.

20. Nash, C. S.: Malignant Disease of the Sinuses, Ann. Otol., Rhin. & Laryng. **44**:220 (March) 1935.

21. Beck, J. C.: Malignant Diseases of the Nose and Nasal Accessory Sinuses, Tr. Am. Acad. Ophth. **36**:20, 1931.

22. Hill, F. T.: Malignant Disease of the Sinuses, Ann. Otol., Rhin. & Laryng. **46**:158 (March) 1937.

Ringertz,[23] in an extensive study, was able to collect 10 cases from Radiumhemmet and Sabbutsberg. He maintained that the anterior ethmoid sinuses and superior part of the nasal cavity are the sites of origin of practically all of such tumors. This opinion is contrary to the findings in this country, where most of these tumors have been found in the antrum and very few intranasally. Ringertz divided these tumors into two histologic types: the alveolar and the pseudopapillary. The alveolar type has generally the same architecture as an adenoma, with areas of invasion, cell atypia and numerous mitoses. The pseudopapillary type is almost identical with adenocarcinomas of the large bowel. They are composed of nonciliated columnar cells, afranged in papilla-like formation, the stroma being composed of a moderate amount of connective tissue. He stated the belief that the papillary formations were brought about by extension and confluence of the glandular tubules or cryptlike proliferation of the surface epithelium. Hence he applied the term "pseudopapillary."

Geschickter [14] presented the first large series in this country. He collected 15 cases, including the so-called Schneiderian adenocarcinoma. The growth in all but 2 cases occurred intranasally. A good histologic description with photomicrographs were presented. Mucous secretion was a dominant element in most of his cases. All those in his series proved fatal.

Ellis [24] reported a similar case in 1943. He remarked that these tumors were composed of tall cylindric cells and suggested that they be termed "cylindric cell cancer."

COMMENT

As indicated in the literature, adenocarcinoma and basal cell carcinoma are two of the rare forms of cancer in the nasal and paranasal cavities. The majority arise in the region of the middle turbinate body at the embryonic site of the outpouching of the sinuses. From this point they may spread into the sinus or into the nasal cavity. The average age at the time of diagnosis is 55 years. The symptoms are similar to those of other intranasal tumors. The commonest are difficulty in breathing, nasal discharge and in severe cases, epistaxis, headache and facial deformities. At operation it is commonly noted that there is excessive bleeding in those cases in which later the tumor is proved to be malignant.

Whitmore [25] has shown that during embryonic life epithelial cells are endowed with potentialities to develop several types of epithelium, and these potentialities are retained by the basal cells throughout adult life. Thus, one may see the pseudostratified, ciliated, columnar epithelium transforming, under chronic irritation, to a squamous type or, on the other hand, to a low columnar or cuboidal type. As in

23. Ringertz: Malignancy of Sinuses, Acta laryngol. scandinav. **27**:120, 1939.

24. Ellis, B. E.: Unusual Nasal Tumor, Tr. Am. Laryng., Rhin. & Otol. Soc., 1943, p. 97.

25. Whitmore, E. R.: La naturaleza de la metaplasia y de la degeneración-maligna, Bol. Liga contra el cáncer **13**:263 (Aug.) 1938.

other parts of the body, this metaplasia is usually preceded by a degree of hyperplasia.

In the case of the basaloma, basal cells proliferate downward, causing a proliferation of connective tissue, which eventually goes on to hyalinization. Occasionally, the stroma undergoes a mucoid degeneration and the epithelial cells arrange themselves in an acinar structure, thus bringing about the adenocystic appearance which is so characteristic.

The origin of the adenocarcinoma can be traced to the mucous glands, although in this case many of the glands in the neoplasm give evidence of their anaplasia by failure to produce mucin. Some authors, including Ewing,[26] trace a small group of adenocarcinomas to the schneiderian membrane, hence the name schneiderian carcinoma.

The type of irritation which incites this abnormal cellular activity is often obscure. However, as Geschickter [14] mentioned, these tumors are accompanied by the formation of nasal polypi. He mentions three instances in which there were repeated operations for benign polypi before the malignant nature of the condition was suspected. Cancerous changes of polypi in the intestinal tract, bladder and uterus are not uncommon.

Some authors consider polypi in these regions to be precancerous. On the other hand, malignant metaplasia of nasal polypi has been questioned by pathologists and rhinologists. Ewing [26] stressed the lack of neoplastic features, even in progressive and persistant polypi. Because of the uniformity of epithelial cells, he has branded them the purest example of pseudoneoplasm. The association of polypi with malignant tumors has been looked on by others as incidental or as a result of the primary growth. However, the literature shows that almost all malignant growths were preceded by polypi. This observation is also true for the cases presented here. Wagers [27] and Goldman [28] have gone so far as to state that polypi may be precancerous, in this region. Each supported this contention with cases.

Inasmuch as many polypi are never examined histologically, owing to the widespread feeling that they are not neoplastic, some early cases of malignant growths may be overlooked. Since it has been shown that polyps may undergo cancerous changes, every one

26. Ewing, J.: Neoplastic Diseases, Philadelphia, W. B. Saunders Company, 1928, p. 30.

27. Wagers, A. J.: Intranasal Carcinoma in Association with Nasal Polypi, Laryngoscope **24**:12 (Jan.) 1924.

28. Goldman, I. B.: Carcinomatous Metaplasia in Case of Uncontrollable Polyposis of Nose, Laryngoscope **47**:836 (Nov.) 1937.

should be studied carefully for proof of its benign character. In cases in which they are recurrent, and out of proportion to the apparent disease, there should be repeated biopsies.

SUMMARY

Two cases of rare tumors of the nasal cavity are presented, 1 a cystic basal cell carcinoma, the other an adenocarcinoma. Each was believed clinically to be a polyp. The world's literature concerning each of such tumors has been reviewed and presented. Careful histologic study has caused comment on the possible histogenesis of these tumors.

ETIOLOGY OF OTOMYCOSIS

I. Mycologic Flora of the Ear

LEANOR D. HALEY, Ph.D.
DURHAM, N. C.

OTOMYCOSIS was first recognized in 1844 by Mayer, who, according to Wolf,[1] reported the presence of a "mycotic parasite in the pus of a draining ear." Hall[2] stated that the first fungus to be isolated from ears was identified as an Aspergillus in 1867 by Prof. Schwartz of Halle. Since these initial reports, many fungi have been isolated from patients with otomycosis, and medical literature is replete with publications concerning the cause of this disease. A recent review of the literature on this subject by Wolf[1] has revealed that "at least 53 different species of fungi have been reported to cause otomycosis."

There is much controversy among otologists, however, concerning the significance of those fungi which have been isolated from obviously infected ears in regard to their role as primary infectious agents, as secondary invaders or as harmless contaminants of the auditory canal. While it is the view of some investigators that inflammation of the ear must precede invasion by a fungus, other investigators have expressed the belief that the inflammatory process results from penetration into the deeper and more sensitive portions of the auditory canal by the fungus, which is the primary agent of the infection. The presence of bacteria in the auditory canal, however, has posed the question of their role as primary invaders while the fungi act only as secondary invaders. It is the opinion also of some investigators that an abnormal secretion of the external meatus, such as is found in eczema or chronic purulent otitis media, favors the growth of fungi which are contaminants of the canal. Fungi isolated from such ears, therefore, are thought to be coincidental and of no etiologic significance.

To settle this problem of the causation of otomycosis, it is essential to know something of the mycotic and the bacterial flora of the normal ear, as well as of the diseased ear. The fungous flora should be cor-

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This article and other articles in this series constitute a portion of the material submitted by the author to the faculty of Duke University in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

1. Wolf, F. T.: The Relation of Various Fungi to Otomycosis, Arch. Otolaryng. **46**:361 (Sept.) 1947.

2. Hall, L. B.: Aspergillus in the Ear, Am. J. M. Sc. **73**:559, 1877.

related with the bacterial flora to determine any significant occurrence of a fungus with a bacterium. Should such a combination of organisms be discovered to be necessary to initiate infection, this information concerning the relation would be extremely important from the point of view of specific therapy. Many of the bacteria are sensitive to sulfonamides and antibiotics, and the fungi are resistant. The use of such drugs to eliminate the bacteria, should they prove an important factor in enabling fungi to become pathogenic, would greatly facilitate the treatment of so-called otomycosis. Few investigators have undertaken to determine these floras. To date, the reports of Syverton and his associates [3] and Salvin and Lewis [4] are the only ones in which a critical experimental approach to such studies has been made. It is hoped that the following mycologic study will contribute further to the body of knowledge. The bacterial flora of the ear will be discussed in a subsequent report.

METHOD OF CULTURING

With few exceptions, the material used in this study was collected from patients seen in the ear, nose and throat clinic of the Duke Hospital; some of the material, however, was collected for me by Dr. W. W. Eagle from his private patients.

After the patient's history was taken, each ear was examined with the otoscope to observe the presence of cerumen, inflammation and denudation, the condition of the drum and whether there was any evidence of fungous growth. Sterile swabs were inserted into the auditory canal, two to an ear, and then placed in a sterile test tube. They were taken to the laboratory, where one was streaked across the surface of two tubes of Sabouraud's medium and the other swab was used in making potassium hydroxide preparations, which were carefully examined for the presence of hyphae, spores or budding yeasts. The fungus cultures were kept at room temperature—22 to 28 C.—and were observed frequently over a four week period. If no growth occurred during this period, the cultures were considered negative.

Although Sabouraud's glucose agar was used for an isolation medium, Czapek's agar was used for the final identification of species of Aspergillus and Penicillum, based on the keys to be found in "A Manual of the Aspergilli" by Thom and Raper [5] and "The Penicillia" by Thom.[6]

RESULTS

During this study thirty-nine species of fungi were isolated and identified, many of which have been listed by Wolf [1] as previously isolated from the ears. Table 1 contains a list of the species isolated from 216 normal ears and 367 infected ears.

3. Syverton, J. T.; Hess, W. R., and Krafchuk, J. K.: Otitis Externa: Clinical Observations and Microbiologic Flora, Arch. Otolaryng. **43**:213 (March) 1946.

4. Salvin, S. B., and Lewis, M. L.: External Otitis, with Additional Studies on the Genus Pseudomonas, J. Bact. **51**:495 (April) 1946.

5. Thom, C., and Raper, K. B.: A Manual of the Aspergilli, Baltimore, Williams & Wilkins Company, 1945.

6. Thom, C.: The Penicillia, Baltimore, Williams & Wilkins Company, 1930.

On comparison of the species of fungi isolated from normal ears with those isolated from pathologic ears, it may be noted that in many cases the same fungi were common to the two groups. It is interesting

TABLE 1.—*Kinds of Fungi Isolated from Normal Ears Contrasted with Kinds Isolated from Infected Ears*

Identity of Fungus	Present in Normal Ears	Present in Infected Ears
Hormodendrum sp.	Yes	Yes
Alternaria sp.	Yes	Yes
Penicillium chrysogenum Thom	Yes	....
Penicillium frequentans Westling	Yes	....
Penicillium luteum Sopp	....	Yes
Penicillium brevis Bainier and Sartory	Yes	Yes
Penicillium grizo-roseum Dierckx	....	Yes
Penicillium spinulosum Thom	Yes	Yes
Penicillium tardum Thom	Yes	....
Penicillium cyaneo-fulvum Biourge	....	Yes
Penicillium brevi-compactum Dierckx	....	Yes
Penicillium flavi-dorsum Biourge	....	Yes
Aspergillus fumigatus Fresenius	Yes	Yes
Aspergillus ochraceus Wilhelm	Yes	....
Aspergillus versicolor (Vuillemin) Tirabaschi	....	Yes
Aspergillus niger van Tieghen	Yes	Yes
Aspergillus humicola Chaudhuri and Sachar	Yes	Yes
Aspergillus sydowi (Bainier and Sartory) Thom and Church	....	Yes
Aspergillus repens series	Yes	Yes
Aspergillus glaucus Link	Yes	Yes
Aspergillus flavus Link	....	Yes
Aspergillus terreus Thom	....	Yes
Aspergillus amstelodami (Mangin) Thom and Church	Yes	Yes
Pink torula	Yes	Yes
Trichoderma viride Pers. ex Fries	Yes	Yes
Saccharomyces sp.	Yes	Yes
Paecilomyces varioti Bainier	Yes	Yes
Rhizopus nigricans Ehrenberg	Yes	Yes
Streptomyces sp.	Yes	Yes
Scopulariopsis sp.	Yes	....
Hormodendrum olivaceum (Corda) Bonorden	....	Yes
Coniothyrium sp.	....	Yes
Candida tropicalis (Castellani) Berkhout	Yes	Yes
Oospora sp.	Yes	Yes
Trichophyton mentagrophytes (Robin) Blanchard	....	Yes
Pullularia pullulans Berkhout	....	Yes
Cephalosporium sp.	....	Yes
Mucor sp.	Yes	Yes
Trichothecium roseum Link	....	Yes

to note that Aspergillus fumigatus, which is recognized as a pathogenic fungus, was found in normal ears as well as in infected ears.

Wolf listed eighteen species of Aspergillus as having been associated with otomycosis. Of these eighteen species, eleven are identical with those isolated during this study. The remaining seven species of Aspergillus include oryzae, fischeri, nidulans, flavescens, phoenicis, macfiei and montevidensis.

This study yielded ten species of Penicillium, four of which Wolf reported as previously isolated from persons with otomycosis. These four species include bicolor, crustaceum, eborinum and jantho-citrinum.

Other fungi listed by Wolf as being associated with otomycosis and not recovered from cultures made during this study include Syncephalastrum racemosum, Candida albicans, 2 other species of yeastlike fungi, a species of Achorion and Trichophyton violaceum. Isolated during these studies, on the other hand, and not listed by Wolf, are Paecilomyces varioti, Pullularia pullulans, a Coniothyrium species, several species of Oospora and Trichophyton mentagrophytes.

TABLE 2.—*Seasonal Incidence of Fungi Isolated from the Auditory Canals of 305 Patients*

Genus	October	November	December	January	February	March	April	May	June
Number of cultures	33	105	40	178	117	60	25	40	10
Number of isolates	14	51	13	20	44	14	23	13	4
Hormodendrum	6	12	3	5	4	..	2	..	..
Alternaria	2	8	1	1	..	..	..	..	..
Pink torula	2	3	1	2	2	..	2	..	..
Trichophyton	1	1	..	..	..	..	..	..	..
Aspergillus	1	7	4	11	17	17	7	4	3
Penicillium	1	5	2	11	14	15	6	2	..
Actinomycetes	..	1	..	..	4	1	1	2	..
Sterile hyphae	..	6	..	5	..	..	2	4	1
Trichoderma	..	4	1	..	..	..	..	..	..
Scopulariopsis	..	1	..	..	..	..	..	..	..
Rhizopus	..	1	..	..	..	1	1	..	..
Mucor	..	..	..	..	2	..	..	..	..
Coniothyrium	..	1	..	..	..	..	..	..	..
Candida	..	1	..	..	..	..	..	..	..
Oospora	..	1	..	..	2	..	..	..	..
Pullularia	..	2	..	..	..	..	..	..	..
Cephalosporium	..	..	..	1	..	..	..	..	..
Trichotheeium	..	..	..	1	..	..	..	..	..
Paecilomyces	..	..	..	3	..	..	2	..	..
Saccharomyces	1	3	1	4	1	..	2	..	..

An attempt was made to determine whether a relation existed between the species of fungi isolated and the season of the year. In table 2 the fungi isolated during each of nine consecutive months are listed. It may be noted that species of Aspergillus and Penicillium were isolated during each of the nine months, except June, and appeared to predominate during January, February and March.

Hormodendrum, Alternaria and a species of Saccharomyces were more prevalent during the fall and winter. This agrees in part with the observations made by Durham,[7] who noted that Alternaria and Hormodendrum were present in greatest concentration during the

7. Durham, O. C., in Bieberdorf, F. W., and Hampton, S. F.: Airborne Fungi in Allergic Disease: Survey of Airborne Fungi in San Antonio, Texas, Area; Incidence of Skin Reactions with Mold Extracts, Ann. Allergy **4**:23 (Jan.) 1946.

summer and fall. Alternaria species were not recovered during the last five months of this survey. Marrow, Lowe and Price [8] studied the air-borne molds in central and southwestern United States over a two year period and observed that Alternaria occurred oftener than did any other genus, with Hormodendrum being a close second. They also noted that species of Aspergillus were the third commonest kinds recovered, with Penicillium fourth in order of prominence.

COMMENT

It is evident that species of Aspergillus and Penicillium may be isolated at any time from the external auditory canal despite the condition of the ears.

The occurrence of Aspergillus niger and Aspergillus fumigatus both in normal and in pathologic ears emphasizes the fact that some factor is essential in giving rise to a pathologic state. Both these species have been recovered oftener than any other fungus from patients with otomycosis.

The fact that pathogenic fungi exist in the external auditory canal without causing symptoms is sufficient evidence that it can no longer be stated categorically that an organism is either "pathogenic" or "nonpathogenic," depending on the presence or absence of symptoms, nor can a fungus be considered nonpathogenic because it is a saprophyte and not a parasite. In fact, many of the fungi isolated from patients with otomycosis are saprophytes.

Because many patients have identical species of fungi in their auditory canals and yet only a few of them present symptoms of otomycosis, factors other than the pathogenic properties of the fungi per se must be considered. One such factor may be the bacterial flora of these ears: Are there species of bacteria found in ears which under certain conditions enable a fungus to penetrate into the tissues of the external auditory canal and set up a pathologic state? Another factor may be a state of hypersensitivity of a person to a foreign substance, such as fungous spores, in the auditory canal. Also, trauma should be considered as a contributing factor, in that preexisting tissue damage may be necessary for these fungi of low pathogenic titer to initiate infection. These factors have been considered and will be discussed in subsequent reports.

SUMMARY

This study involves a discussion of the mycotic flora of the ears of patients both with and without symptoms of a pathologic state.

8. Marrow, M. B.; Lowe, E. P., and Price, H. E.: Mold Fungi in the Etiology of Respiratory Allergic Diseases: I. A Survey of Air-Borne Molds, J. Allergy **13**:215 (March) 1942.

Some species of fungi isolated from the external auditory canal were observed to be present in both normal and pathologic ears.

Among those species of fungi isolated were included Aspergillus niger, Aspergillus fumigatus, species of Penicillium and Trichophyton mentagrophytes.

Species of Aspergillus and Penicillium were isolated throughout a nine month survey.

The possible role of hypersensitivity and trauma in otomycosis is discussed.

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Dr. Frederick A. Wolf and Dr. Norman F. Conant assisted in this study.

ETIOLOGY OF OTOMYCOSIS

II. Bacterial Flora of the Ear

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IN AN EARLIER report [1] it was stated that the causation of otomycosis is a controversial subject among otologists. It was suggested that an intelligent approach to this problem might be made by attempting to determine the mycotic and the bacterial floras of normal and of pathologic ears; that by correlating the fungous flora with the bacterial flora of these ears some basis might be obtained to enable one to determine the etiologic agent of otomycosis and, thereby, facilitate the proper treatment of this disease.

The medical literature contains few reports of studies of the bacterial flora of the ears. Moreover, little work has been done toward correlating the bacterial and the fungous floras of either normal or infected ears.

According to Salvin and Lewis,[2] Mincheu and co-workers stated that there was little difference in the bacterial flora of pathologic auditory canals "as compared with that of normal ones and, therefore, that fungi (chiefly members of the genus Aspergillus) are the important etiological organism."

Syverton, Hess and Krafchuk [3] attempted to determine whether otitis externa was due primarily to fungous infection or to bacterial infection. They first studied the bacterial flora of 16 normal ears, recovering Staphylococcus (Micrococcus) pyogenes var. aureus once, Staphylococcus (Micrococcus) pyogenes var. albus ten times, micrococci thirteen times, Sarcina eight times, diphtheroids ten times and unidentified bacilli on two occasions. They noted that the "causative agent of otitis externa can be any one of a variety of bacteria and fungi." Among the commonest organisms isolated from their patients were Pseudomonas aeruginosa, Klebsiella ozaenae, Staph. pyogenes var. aureus (hemolytic), Proteus sp., Aspergillus sp., Monilia tropicalis and Actinomyces sp. In their conclusions Syverton and his associates stated that the "role

From the Department of Bacteriology, Duke Hospital.

1. Haley, L. D.: Etiology of Otomycosis: I. Mycotic Flora of the Ear, Arch. Otolaryng., this issue, p. 202.

2. Salvin, S. B., and Lewis, M. L.: External Otitis, with Additional Studies on the Genus Pseudomonas, J. Bact. **51**:495 (April) 1946.

3. Syverton, J. T.; Hess, W. R., and Krafchuk, J.: Otitis Externa: Clinical Observations and Microbiologic Flora, Arch. Otolaryng. **43**:213 (March) 1946.

of fungi in otitis externa has undoubtedly been overemphasized, whether as primary or secondary agents of infection." They failed to recover any fungus in 75 per cent of their patients with otitis externa.

Salvin and Lewis [2] studied the bacterial flora of 100 patients with otitis externa. Of the patients from whom bacteria were isolated "45 had Pseudomonas; 27, Staphylococcus albus; 14, unidentified diphtheroids; 9, viridans streptococcus; 9, Chromobacter; 2, Sarcina lutea; 2, hemolytic streptococci; and 1, Staphylococcus aureus." Among the 100 patients only 16 per cent had fungi. From none of the 25 normal ears which were studied did they succeed in isolating fungi or Pseudomonas. In discussing their findings, Salvin and Lewis stated that a chance probability of Pseudomonas sp. being an etiologic agent of otitis externa was less than 1 in 10,000; Staph. pyogenes var. albus, 1 in 2,000; fungi, 2 in 100; diphtheroids, 1 in 10, and Staph. pyogenes var. aureus, 3 in 5.

Hayes and Hall [4] in their discussion on the treatment of otogenic infections stated that otitits externa was due predominantly to Ps. aeruginosa. They expressed the belief, too, that fungi have been greatly overemphasized as the causative agents of diseases of the ear.

METHOD OF CULTURING

Between the months of October 1946 and May 1947 the bacterial flora of the auditory canals of 305 patients seen in the ear, nose and throat clinic at Duke Hospital was determined. Of these 305 patients, 106 came to the clinic for some complaint not related to the ears and were therefore considered a control, or "normal ear," group. The remaining 199 patients were in the clinic with complaints of some type of "ear trouble." During the eight month period a total of 525 cultures was made from these patients.

A complete history was taken for each patient, followed by an examination of the ears with an otoscope. Care was taken to observe the presence of cerumen, inflammation and denudation, the condition of the drum and the presence of any fungous growth. Sterile swabs were inserted into the external auditory canal, two to an ear, and then put into a sterile test tube. They were taken to the laboratory, where one swab was placed in a tube of beef heart infusion broth of p_H 7.4, and the other one was streaked across the surface of a blood agar plate. These were incubated for twenty-four hours at 37 C., after which they were examined and all organisms identified.

RESULTS

Normal Ears.—The bacterial flora and the monthly incidence of these bacterial species in the ears of 106 patients in the control group are presented in table 1. From this table it is noted that Staph. pyogenes var. albus, Bacillus subtilis and diphtheroids were by far the most commonly present organisms in the external auditory canal. This is not surprising, since these species also make up a large portion of the normal

4. Hayes, M. B., and Hall, C. F.: The Management of Otogenic Infection, Tr. Am. Acad. Ophth. **51**:149 (Jan.-Feb.) 1947.

flora of the skin. They are also recovered with great ease from the air of dwellings and laboratories. It is further noted from this table that Escherichia coli was recovered always in pure culture. Proteus sp. was recovered in pure culture four out of five times; the fifth time a Micrococcus was also present.

In those isolations in which more than one organism was recovered, it was noted that Staph. pyogenes var. albus and aureus, diphtheroids, Neisseria catarrhalis and Neisseria flava were the ones occurring together most frequently.

It is observed from this table that Staph. pyogenes var. albus and aureus, diphtheroids and B. subtilis occurred in quite the same proportion throughout the entire period, with the exception of May, when only Staph. pyogenes var. albus, diphtheroids, Sarcina sp. and alpha strepto-

TABLE 1.—*Monthly Incidence of Bacterial Species Recovered from Normal Ears of 106 Patients*

	Percentage							
Micro-Organism	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May
Staph. pyogenes albus	48.0	47.3	28.9	42.5	45.0	50.0	35.2	42.9
Staph. pyogenes aureus	4.2	9.2	0.0	5.0	1.3	0.0	5.9	0.0
M. citreus	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0
M. flavus	0.0	0.0	5.6	1.1	6.4	0.0	23.5	0.0
Diphtheroids	16.0	15.8	27.7	11.4	20.0	25.0	11.8	14.2
B. subtilis	24.0	17.1	11.1	25.2	18.7	16.5	11.8	14.2
N. catarrhalis	4.0	0.0	11.1	2.2	3.7	0.0	5.8	0.0
Proteus sp.	4.0	2.6	0.0	1.1	0.0	0.0	5.8	0.0
E. coli	0.0	1.3	5.6	3.5	1.2	8.4	0.0	0.0
Serratia sp.	0.0	3.9	0.0	0.0	0.0	0.0	0.0	0.0
Sarcina sp.	0.0	1.3	0.0	2.8	2.5	0.0	0.0	14.2
Alpha streptococcus	0.0	0.0	0.0	1.1	1.2	0.0	0.0	28.7
Str. faecalis	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0

coccus were isolated. It is also interesting to note that alpha streptococcus was far more predominant in May than in any other month during which cultures were made. At no time was Pseudomonas sp. isolated from the normal ears.

Infected Ears.—Of the 199 patients who suffered from diseased ears, 93 had otitis media; 3, otitis externa; 3, mastoiditis; 59, impacted wax; 5, eczema; 4, secretory otitis; 10, pruritus; 11, pain; 11, otomycosis; 4, deafness, and 7, cholesteatoma. The incidence of bacterial flora in the ears of these patients is presented in table 2. In this table it should be noted that cultures from the infected ears not only yielded the same species of bacteria as were isolated from normal ears but also included Ps. aeruginosa and K. ozaenae. Staph. pyogenes var. albus, diphtheroids and B. subtilis also were isolated in large numbers from these infected ears.

In patients with otitis externa E. coli and Staph. pyogenes var. albus were recovered on two occasions. Neither Ps. aeruginosa nor Proteus sp., however, was isolated from any of the 3 persons with this complaint.

Ps. aeruginosa, E. coli and Staph. pyogenes var. aureus were predominating organisms in patients with otitis media. A third of the strains of Staph. pyogenes var. aureus were hemolytic. This appears significant in view of the fact that only an eighth of the strains of Staph. pyogenes var. aureus isolated from normal ears were hemolytic.

TABLE 2.—*Incidence of Bacterial Species Isolated from Infected Ears of 109 Patients*

Diagnosis	Staph. Pyogenes Albus		Staph. Pyogenes Aureus		Diphtheroids		B. Subtilis		N. Catarrhalis		Sarcina Sp.		Serratia Sp.		Alpha Streptococcus		Proteus Sp.		E. Coli		Ps. Aeruginosa		M. Flavus		K. Ozaenae		M. Citreus	
	R*	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L
Otitis media																												
Bilateral	11	9	2	2	3	2	6	5	2	1	1	0	3	0	5	2	9	10	14	14	4	4	2	0	0	1	1	0
Right ear	2	6	2	2	1	1	0	2	0	1	2	0	1	0	0	0	1	1	3	1	1	0	1	0	0	0	0	0
Left ear	16	10	6	7	11	6	11	9	1	2	0	0	0	0	1	0	2	6	0	1	0	6	2	0	0	0	0	0
Otitis externa	2	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0
Otomycosis	5	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0
Recurrent impaction of wax	42	2	0	0	10	1	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
Pruritus	4	3	0	1	3	3	2	3	0	0	0	0	0	0	0	0	1	1	2	1	0	0	0	1	0	0	0	0
Deafness	3	2	1	0	0	1	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pain	14	11	2	2	7	4	5	4	0	0	2	0	0	0	1	0	0	1	3	0	0	0	0	0	2	0	0	0
Eczema	5	3	2	0	0	3	1	1	0	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0

* R indicates the right ear and L the left ear.

TABLE 3.—*Monthly Incidence of Bacterial Species Recovered from Infected Ears of 199 Patients*

Micro-Organism	Percentage							
	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May
Staph. pyogenes albus	33.3	22.6	14.3*	37.8†	47.8	31.8	37.4	27.2
Staph. pyogenes aureus	0.0	9.4‡	7.4	11.2	2.1	10.6	0.9	0.0
M. citreus	4.8	0.0	0.0	0.7	0.0	0.0	0.0	0.0
M. flavus	0.0	1.9	0.0	1.4	2.1	2.1	6.5	9.1
Diphtheroids	14.3	11.3	14.8	11.2	12.5	21.3	14.9	9.1
B. subtilis	10.0	18.8	7.4	8.3	12.5	10.6	22.4	0.0
N. catarrhalis	0.0	0.0	3.7	1.4	2.1	4.3	3.7	0.0
Ps. aeruginosa	10.0	1.9	7.4	5.6	0.0	0.0	0.0	18.2
Serratia sp.	0.0	5.8	0.0	0.7	0.0	0.0	0.9	9.1
Sarcina sp.	0.0	0.0	3.7	1.4	2.1	8.6	0.9	0.0
K. ozaenae	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0
Proteus sp.	0.0	16.9	7.4	11.2	4.2	0.0	4.7	9.1
Alpha streptococcus	0.0	1.9	0.0	4.2	2.1	0.0	1.8	0.0
Str. faecalis	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0
E. coli	28.6	9.5	23.4	4.2	10.4	10.7	5.6	18.2

* One strain was hemolytic.
† Two strains were hemolytic.
‡ Three strains were hemolytic.

In the 11 patients whose disorder was diagnosed as otomycosis, there was no exudate and the auditory canal showed dry scaling. Staph. pyogenes var. albus and aureus, E. coli and diphtheroids were cultured from the ears of these patients. Neither Proteus sp. nor Ps. aeruginosa was obtained in the cultures.

An analysis of the predominating bacterial flora of the diseased ears according to the month of the year was made and is presented in table 3. It should be noted that Ps. aeruginosa was more prevalent in pathologic ears during May than during any other month, but that neither Proteus nor E. coli was recovered during this period in the normal ears. Hayes and Hall [4] stated that one finds gram-negative rods, particularly the pyocyaneus and proteus groups, to be the principal organisms in otogenic infections during the warm months. Salvin and Lewis [2] also described Pseudomonas sp. as most dominant in the midsummer months when the temperature was about 82 F. (about 28 C.).

Alpha streptococcus, which made up 28.7 per cent of the species isolated from normal ears during the month of May, was not isolated at any time during this month from pathologic ears.

The incidence of Staph. pyogenes var. albus in diseased ears as compared with normal ears was less in all months, with the exception of February and April. On the other hand, Staph. pyogenes var. aureus was isolated in about the same proportion from the two groups of ears, but in the diseased ears the hemolytic strains were predominant.

COMMENT

It seems evident from this study that certain micro-organisms, such as Staph. pyogenes var. albus and aureus, diphtheroids and B. subtilis, Proteus sp. and E. coli, are constantly present in the external auditory canal, regardless of the condition of the ears.

It is probable that some of the organisms found in the normal ear may have the potentiality of inducing infection, provided proper conditions exist. Since 50 per cent of the patients admitted that they probed their ears either with a toothpick or matchstick or with their index finger, trauma may be a predisposing factor. Also, since 20 per cent of the patients gave a history of swimming a short time before onset of the infection, moisture should be considered.

In attempting to correlate the fungous flora [1] with the bacterial flora of the ear, several interesting observations were made. On all occasions, with 3 exceptions, fungi and bacteria occurred together in the ears. One of these exceptions was a patient with "sinus trouble" who appeared in the clinic during November. Hormodendrum was cultured from one swab, but bacteria were not isolated. In March 2 patients with recurrent impaction of wax had negative bacterial cultures, but Rhizopus nigricans was isolated from one and a species of Hormodendrum from the other.

Species of Hormodendrum, Alterneria, Torula and Saccharomyces were isolated from ears having a mixed bacterial flora; this mixture usually consisted of any of the following: Staph. pyogenes var. albus, and aureus, Sarcina sp., diphtheroids, B. subtilis and alpha streptococcus.

The same species of fungi were also isolated from ears that yielded only a single species of bacteria. On one occasion Aspergillus fumigatus was recovered bilaterally from a patient whose bacterial flora consisted of a pure culture of hemolytic Staph. pyogenes var. aureus. A species of Actinomyces was recovered on several occasions when Staph. pyogenes var. albus and diphtheroids were also present. Aspergillus niger and Aspergillus flavus were recovered on one occasion in association with E. coli. All other cultures which yielded E. coli were consistently negative for any species of fungus. At no time was any species of fungus isolated from an ear in which Proteus was present.

During this study 6 patients were seen whose diagnosis of otomycosis was proved by culture. The fungi isolated from these patients included Aspergillus niger, Aspergillus terreus, Aspergillus candidus and Trichophyton mentagrophytes. The species of bacteria isolated from these 6 patients included Staph. pyogenes var. albus, N. catarrhalis, B. subtilis and diphtheroids. Of the five strains of Staph. pyogenes var. albus isolated, only one was hemolytic.

Evidence from the present study does not lend support to the idea that a fungous infection in the ear must be secondary to a bacterial infection. Rather, it would seem to indicate that fungi have the ability to be primary agents in otomycosis, as well as in the systemic mycoses.

SUMMARY

This article is the second in a study of the causation of otomycosis; it involves a survey of the bacterial flora of normal and pathologic ears.

Bacteria isolated from the external auditory canal were in many instances observed to be present in both groups of ears.

The prevalent species of bacteria recovered included Staphylococcus pyogenes var. albus and aureus, diphtheroids, Bacillus subtilis, Proteus sp. and Escherichia coli.

Pseudomonas aeruginosa was recovered only from patients having a complaint of "ear trouble."

There was no evidence that the species of bacteria noted to be associated with fungi in the external auditory canal influenced the incidence of fungi in the ear.

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ETIOLOGY OF OTOMYCOSIS

III. Observations on Attempts to Induce Otomycosis in Rabbits

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IN EARLIER papers, in which a survey of the mycotic and of the bacterial flora of normal and pathologic ears was reported, it was stated that factors other than the pathogenic properties of the fungi per se must be considered. This statement was based on the observation that many patients have identical species of fungi in their auditory canal, yet only a few of them present symptoms of otomycosis. Among the factors to be considered are trauma and hypersensitivity.

It was decided, therefore, to attempt experimentally to induce otomycosis in rabbits, bearing in mind those factors thought to be of importance in the etiology of otomycosis. From this series of animal experiments it was hoped that information could be obtained that would serve as a basis from which further studies on hypersensitivity of patients with fungous infections might be made and that would throw light on the subject of trauma.

METHOD OF STUDY

All rabbits used in this series of experiments were observed under normal conditions for a period of two weeks, during which time the mycotic and the bacterial flora of the external auditory canal was determined. Prior to use, all rabbits were shown by an intradermal skin test not to be sensitive to Aspergillus niger. The material used for the skin tests consisted of a saline suspension of the fungus prepared from mats grown in Czapek's liquid medium for ten days. These mats were ground in sterile tissue grinders in a small amount of 0.9 per cent saline solution. The material was then placed in sterile vaccine bottles and tested for bacterial sterility. A 0.1 ml. portion of the antigen was given intradermally in performing the skin tests. The severity of reaction was based on the diameter of the erythematous area produced and was recorded on the basis of an arbitrary scale. Induration was noticed only in those reactions considered to be 3 or 4 plus. A control skin test, using Czapek's broth, was given during the first part of these studies. During the later experiments a nonsensitized rabbit served as a control.

The rabbits were divided into five groups: Group 1 consisted of animals into the left ears of which Aspergillus niger spores were introduced on one occasion. Group 2 comprised animals into whose left ears spores were introduced repeatedly until a state of hypersensitivity developed. Into the animals of group 3 1.0 ml. of a ground suspension of Aspergillus niger was injected subcutaneously on one occasion. The animals of group 4 received repeated injections of the fungus antigen

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subcutaneously until a state of hypersensitivity existed. Group 5 consisted of rabbits that were not inoculated with Aspergillus niger spores but were otherwise subjected to the same environment and all other conditions as were the rabbits of the first four groups.

The spores introduced into the rabbits' ears were obtained from one week old cultures of Aspergillus niger grown on Sabouraud's medium and were collected after gentle shaking of the culture tube and its inversion into a small, sterile vial. The antigen used for the subcutaneous injections was the same as that employed in performing the skin tests.

The spores were introduced into the ears without trauma by insufflation. Also, spores were introduced with a dry swab, which had been dipped previously into a vial containing spores, by rubbing the swab along the length of the external auditory canal. The rubbing of the canal walls, however, produced small bleeding sites. A reaction to the fungous spores included the presence of inflammation, edema, exudate and pain. The two ears of an animal were treated identically except that spores were introduced into the left ear only.

OBSERVATIONS AND RESULTS

The first group of rabbits included those whose ears were inoculated on one occasion with conidia of Aspergillus niger accompanied with slight traumatization. At regular intervals the ears of these animals were examined to note the development of any type of pathologic change or the development of sensitivity. At no time was there evidence of any sort of reaction within the ear, nor did the animals become sensitive to the fungus.

The second group of rabbits contained those whose ears were repeatedly inoculated in the same manner as were those of the animals of group 1. These inoculations were continued until a sensitivity to the fungus could be demonstrated by skin tests. Insufflation of spores into the ears of these sensitized rabbits followed by traumatization eventually induced reactions.

The third group of rabbits in this series of experiments included those given a single 1.0 ml. subcutaneous injection of fungus suspension. Again, as in the first group of rabbits, skin tests for sensitivity to the fungus elicited negative reactions, and there was no reaction in the ears when spores were applied by insufflation or rubbed into the wall of the auditory canal with an applicator.

The fourth group of rabbits, however, received repeated subcutaneous injections of the fungus suspension until positive reactions to skin tests could be demonstrated. After insufflation of spores into the left ears of these sensitized rabbits followed by traumatization a typical reaction was observed.

The fifth group of rabbits served as a control for this study. These animals were not inoculated in any manner with Aspergillus niger spores but were otherwise subjected to the same conditions as were the first

four groups of rabbits. The ears of these rabbits were traumatized with an applicator stick so that any pathologic response might be observed. Erythema was noted in all these traumatized ears, with small bleeding sites being observed occasionally. At no time was there any evidence that swelling, pain or exudates were present.

In the second and fourth groups of sensitized rabbits the conidia were insufflated into the ears, thus avoiding trauma. At the end of forty-eight hours, when no evidence of any reaction was present, the inoculated ears were gently traumatized by abrading the wall of the external auditory canal with an applicator stick. Table 1 contains the data from observations on these two groups of rabbits.

TABLE 1.—*Results of Hypersensitivity Studies on Rabbits of Groups 2 and 4*

	Mode of Sensitization			Reaction When Spores Were Placed into Ear of Sensitized Rabbit		Maximum Degree of Reaction				Persistence of Reaction After Final Inoculation, Days	Skin Test Reaction After Ear Returned to Normal
Rabbit Number	Repeated Subcutaneous Injections	Rubbing of Spores into Ears with Applicator (No. of Times)	First Positive Skin Test Reaction	Without Trauma	With Trauma	Inflammation	Edema	Exudate	Pain (Degrees)		
1	..	3	1+	—	+	4+	4+	3+	3	44 *	2+
2	..	4	2+	—	+	4+	4+	3+	3	31 †	2+
3	..	4	2+	—	+	3+	4+	3+	2	..	2+
5	..	5	1+	—	+	2+	2+	2+	2	Rabbit died	
4	3	..	1+	—	+	2+	3+	1+	2	29	3+
6	5	..	3+	—	+	3+	1+	1+	3	15	3+
7	4	..	3+	—	+	2+	2+	1+	3	34	3+
8	4	..	2+	—	+	1+	2+	±	2	7	2+

* Spores were added five consecutive days after onset of the reaction.
† Spores were added two consecutive days after onset of the reaction.

Several interesting facts are noted in this table. Without trauma, spores introduced into the ears of sensitized rabbits did not give rise to reaction. It is shown that the maximum degree of reaction was greater in rabbits 1 and 2 than in any of the others. These rabbits had been reinoculated for several consecutive days following onset of the inflammatory reaction. The degree of hypersensitivity after clinical recovery in the rabbits, with the exception of rabbit 4, was not significantly increased. Rabbit 4 received the smallest amount of antigen subcutaneously and had the weakest skin reaction; hence, the amount of antigen given may have been just sufficient to stimulate the production of antibody. It is also noted in this table that the degree of sensitivity cannot be used as an indicator for the duration and degree of the inflammatory reaction that might be expected when spores are properly introduced into the ear. Rabbit 7 had a 3 plus reaction to the skin test and

an inflammatory reaction that persisted for thirty-four days, as compared with rabbit 6 which also had a 3 plus skin test reaction, but the reaction persisted for only fifteen days. The difference in the degree of reaction in the 2 rabbits is more quantitative than qualitative. There remains the possibility that the differences in the degree of reaction among these animals may be due to the technic used, since the amount of inoculum was not controlled nor was the amount of trauma constant.

There may also have been a relation between the repeated inoculation of conidia into the reactive ears of rabbits 1 and 2 and the degree and duration of the reaction. In order to throw light on this matter it was decided that 5 of these animals, after the ears had returned to normal, should be inoculated again on just one occasion. A period of twenty to thirty days was allowed to pass after the primary allergic reactions, at the end of which time the rabbits were again given skin tests and

TABLE 2.—*Hypersensitivity as a Factor in Recovery Following Inoculation*

Rabbit Number	Skin Test Reaction	Maximum Degree of Reaction				Persistence of Reaction, Days
		Inflammation	Edema	Exudate	Pain (Degrees)	
1	3+	2+	1+	3+	3	21
2	3+	2+	1+	1+	3	18
4	4+	3+	2+	2+	2	15
6	4+	3+	1+	1+	1	15
7	3+	1+	2+	1+	3	19

Aspergillus niger spores were again introduced into the left ears. Table 2 indicates the observations made in this experiment.

On comparison of the inflammatory responses of these rabbits after a second inoculation with the primary inflammatory responses, two possibilities appear that may serve to explain why the degree and duration of reaction should be decreased. The first is that the repeated inoculation with spores aggravated the primary reaction. Rabbit 1 had a reaction that persisted for forty-four days when spores were introduced on five consecutive days after onset of the allergic response, as compared with twenty-one days when the spores were introduced on just one occasion. Rabbit 2 had a reaction that persisted for thirty-one days when spores were given two consecutive times following onset of the inflammatory response, as compared with eighteen days when the spores were introduced into the ear but once. Another possibility is that these rabbits may have built up some degree of resistance to a second reaction as a result of the primary inflammatory response. Such resistance may, therefore, bring about a reaction which persists for a shorter period.

COMMENT

These animal studies, which were undertaken in an attempt to demonstrate whether hypersensitivity to a specific fungus actually could give rise to otomycosis, have given indicative results. It was noted that rabbits which were sensitized to Aspergillus niger by repeated exposure to the fungus actually gave an allergic type of response when, in association with trauma, spores were introduced into their ears, as compared with the negative response given by nonsensitized rabbits. Skin tests performed on the sensitized rabbits indicated that the response was a generalized hypersensitivity. No attempt to induce hypersensitivity by passive transfer was made at this time. It was not possible to produce a typical case of otomycosis in these animals.

The concept that trauma seems to play a significant role in the causation of otomycosis has also been borne out by these animal studies. The cause of trauma may vary, being mechanical or chemical. Mechanical trauma may be induced by such means as scratching with a finger nail, a bobby pin or a matchstick, any of which is capable of setting up a state of inflammation. Menkin [1] in his discussion on the dynamics of inflammation has shown that among the substances known to be present in an inflammatory site are urea, glucose and salts, materials which could serve to make up a medium that would easily support fungous growth.

The true significance of trauma, however, as an important factor in enabling a fungous to start a pathologic state in the ear has not been evaluated. There are systemic mycoses in which it is believed that trauma must be present to enable the fungus to invade the tissues and to set up an infection. The experiments described in this paper indicated trauma to be necessary before spores of Aspergillus niger could produce an inflammatory process in the ears of rabbits. Such a reaction could not be induced by the spores alone or by previously induced sensitivity.

There now remains the problem of applying these observations to patients who come to the clinics with a complaint of otomycosis. Rarely does one find a person who denies having scratched his ears in one manner or another. Hence, the chance that trauma has not been induced in these infected ears is slight. The state of the patient's hypersensitivity to the etiologic agent remains unknown. In a later paper clinical observations are made in an attempt to demonstrate further the roles of trauma and hypersensitivity in the etiology of otomycosis.

1. Menkin, V.: Dynamics of Inflammation: An Inquiry into the Mechanism of Infectious Processes, New York, The Macmillan Company, 1940.

SUMMARY

This report discusses several attempts to produce otomycosis in rabbits. It was noted that a slight amount of trauma must accompany the introduction of fungous spores into the external auditory canal of sensitized rabbits in order to bring about an allergic reaction.

Data have been obtained from animal experiments indicating that rabbits sensitized to Aspergillus niger give an allergic type of reaction when conidia of this fungus are introduced into the ear simultaneously with traumatization. Introduction of spores of Aspergillus niger into ears of nonsensitized animals did not give rise to any reaction.

The problem of applying these observations to patients in the clinic is discussed.

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ETIOLOGY OF OTOMYCOSIS

IV. Clinical Observations

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THE PROGRESS made in recent years in the field of allergy and immunology has provided an explanation for certain human ailments, for example, rheumatic fever, glomerulonephritis, serum sickness and periarteritis nodosa. Dammin and Bukantz [1] stated:

> It has generally been accepted that the development of host hypersensitiveness . . . is the essential pathogenetic basis for the subsequent morphologic alterations characteristic of these diseases and that the lesions observed result from the union of the responsible antigen with its antibody in the tissues of the sensitized host.

Since man is penetrated every day by micro-organisms that "do not leave a record worthy of medical attention," [2] he may nevertheless build antibodies to many of these organisms. Otomycosis also may belong to this type of disease process, since a person may become sensitized to an air-borne fungus. Constitutional and genetic factors, however, may determine which person will become hypersensitive to any particular micro-organism. Lamson and Rogers,[3] in attempting to correlate cutaneous hypersensitivity to molds in atopic patients, showed that there is a "tendency to mold sensitivity in those patients already known to be allergic, as compared to sensitivity in clinically doubtful or negative patients."

PRESENT INVESTIGATION

It was decided, therefore, to make observations bearing on the allergic state of patients having a diagnosis of otomycosis. These patients were from the otology service of Duke Hospital. It was decided also to observe the aural mycotic flora of patients who had no manifestations or complaints referable to the ear. These patients were seen in the allergy clinic.

A complete history, including the allergic status, was taken for each patient who was thought to have otomycosis. Material was then collected from the ears of each patient for culture and identification of fungi, and the patient was given skin tests for sensitivity to species of Alterneria, Hormodendrum, Helmin-

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1. Dammin, G. J., and Bukantz, S. C.: Modification of Biologic Response in Experimental Hypersensitivity, J. A. M. A. **139**:358 (Feb. 5) 1949.

2. Bacterial Allergy, editorial, Ann. Allergy **4**:223 (May-June) 1946.

3. Lamson, R. W., and Rogers, E. L.: Skin Hypersensitivity to Molds: An Attempt to Correlate This with Clinical Allergy, J. Allergy **7**:582 (Sept.) 1936.

thosporium, Aspergillus and Penicillium. The antigens used for this study were extracts of the specific fungus made by culturing the fungus on Sabouraud's slants, washing off the growth with Coca's solution and allowing the mixture to remain in the refrigerator overnight. These extracts were passed through a Seitz filter and tested for sterility before use.

A 0.1 ml. portion of the antigen was injected intradermally into the left arm and the site examined for evidence of any reaction after ten, twenty and thirty minutes. The patient was instructed to return after twenty-four hours for a final reading.

Those patients who were examined in the allergy clinic were tested with dilutions of the following fungus antigens:

Rhizopus	1:100	Monilia (Candida)	1:100
Alternaria	1:100	Fusarium	1:100
Penicillium	1:100	Mucor	1:100
Aspergillus	1:100	Yeast	1:1,000
Trichoderma	1:100	Corn smut	1:1,000
Hormodendrum	1:100	Trichophytin	1:1,000

A total of 15 patients was seen in the allergy clinic during this study. Each of them had a history of allergic rhinitis, asthma or hay fever.

Table 1 contains the data collected on study of these patients.

TABLE 1.—*Results of Fungus Cultures and Skin Tests Performed on Fifteen Patients Examined in the Allergy Clinic*

Number of Patients	Results of Skin Tests	Result of Fungus Cultures
1	Mucor, 2+	—
1	Monilia (Candida), 1+	—
1	Alternaria, ±	—
1	Hormodendrum, ±	—
1	—	Hormodendrum sp.
1	—	Alternaria sp.
1	—	Aspergillus glaucus
8	—	—

Of these patients included in table 1, only 4 had positive skin test reactions to any of the fungus antigens; the patient with sensitivity to Mucor had allergic rhinitis, and the remaining 3 patients with positive skin reactions had asthma.

Twelve patients were seen in the otologic private clinic with the clinical diagnosis of otomycosis. Table 2 contains the data collected on study of these patients.

Examination of table 2 shows that several of the patients suspected of having otomycosis proved to have otitis externa induced by bacteria. Of the 12 patients seen, only 4 had a clinical picture of otomycosis with cultures positive for fungus. Four of the patients had a clinical picture of otomycosis, but cultures of material from the ears yielded Pseudomonas aeruginosa. Three of the remaining 4 patients came to the clinic on several occasions with complaints of pruritus, exfoliation of epithelium and inflammation of the ears. They did not demonstrate the typical picture of otomycosis, nor was it possible to isolate a fungus

from the ears. Despite the fact that they were thought to have otomycosis, it is more probable that these patients had some form of eczema or otitis externa with a bacterium as the etiologic agent. It is admittedly quite difficult, at times, to distinguish otomycosis clinically from chronic seborrheic dermatitis, eczema of an allergic nature or even syphilis, tuberculosis, cancer and diphtheria,[4] as any one of these diseases may be characterized by pruritus, pain, inflammation and exfoliation of the epithelium or by a whitish or yellowish discharge. It cannot, therefore, be too strongly emphasized that all otologists must make cultures before a condition can be correctly diagnosed as otomycosis. All too often the diagnosis of otomycosis is incorrectly based on the clinical picture alone.

TABLE 2.—*Results of Skin Tests Performed on Twelve Patients Suspected of Having Otomycosis*

Patient No.	Result of Fungus Culture	Result of Bacterial Culture	Result of Skin Test
1	Negative	Ps. aeruginosa	Negative
2	Negative	Ps. aeruginosa	Negative
3	Negative	Diphtheroids	Negative
4	Negative	Ps. aeruginosa	2+ with Aspergillus niger in 30 minutes; negative in 48 hours
5	Aspergillus niger	Staph. pyogenes albus	Negative; repeated in 2 wk., still negative
6	Aspergillus niger	B. subtilis	Negative; repeated in 2 wk., still negative
7	Negative	Ps. aeruginosa	Negative
8	Negative	Staph. pyogenes albus; diphtheroids	Negative
9	Negative	Staph. pyogenes albus; diphtheroids	Negative
10	Aspergillus terreus	Staph. pyogenes albus	Negative; repeated in 2 wk., still negative
11	Aspergillus niger	Staph. pyogenes albus; diphtheroids; B. subtilis	Negative; repeated in 2 wk., still negative
12	Negative	B. subtilis; diphtheroids	Negative

The most important observation recorded in table 2 is that none of the patients with a fungus in their ears had a positive skin reaction for fungi. It was noted that 1 patient with otitis externa from whom Ps. aeruginosa was cultured gave a 2 plus skin test reaction for Aspergillus niger in thirty minutes, despite the fact that cultures of material from both ears did not show fungus.

No evidence is at hand from this study, therefore, that would lend support to the theory that the allergic status of the patient is an important factor in otomycosis. It is suggested, however, that these negative

4. Felderman, L.: Infection with Aspergillus Niger: Report of 2 Cases, Arch. Otolaryng. **31**:327 (Feb.) 1940. Conant, N. F., and others: Manual of Clinical Mycology, National Research Council, Division of Medical Sciences (Military Medical Manual), Philadelphia, W. B. Saunders Company, 1944.

skin reactions may not indicate the true allergic status of the patient, since the technic routinely used to determine the allergic state of a person can no longer be used without drastic modification.

Vaughan and Black,[5] in discussing the value of skin tests in contact dermatitis, stated:

> Since the demonstration of tissue antibodies, the presence or absence of circulating antibodies no longer assumes the importance that it did. Evidence of local sensitization in shock tissues, in contrast to general sensitization makes the absence of systemic sensitization in contact dermatitis appear less important.

Alexander and McConnell [6] showed that the results of skin tests vary, depending on the locus of the tissues tested. They observed in patients with hay fever that the skin on the trunk of the body gave consistently larger reactive areas than that on the extremities, and they listed several sources of error in performing a skin test. These included (1) depth of injection, (2) amount of antigen given and (3) size of wheal, which depends on factors such as texture of skin and capillary supply.

Rudolph and Cohen,[7] in a discussion on negative skin reactions found in patients with vasomotor rhinitis, stated that "it is not unusual to find patients with seasonal allergic rhinitis who give negative skin reactions." They noted that 8 per cent of 500 patients with a nasal allergy failed to give positive skin reactions. Since this was a local nasal allergy, they advocated the use of the mucous membrane in order to obtain a positive test result.

Sulzberger [8] stated that in cases of allergy due to a micro-organism it was often the region in proximity to the affected area that responded to the specific antigen rather than a distant area tested at the same time. From the preceding discussion it would seem better to test an area of the auditory canal for sensitivity to the etiologic agent in case of otomycosis than a site far removed from the infected area. It is highly probable that one is dealing with a localized tissue sensitivity, and until a technic is developed for testing patients with otomycosis for a local sensitivity the possible role of hypersensitivity in this disease cannot be ruled out.

At the same time it must also be kept in mind that some other as yet unknown factor may interfere with the antigen-antibody reaction. As Dammin and Bukantz [1] pointed out: "The exact nature of the antigens and antibodies involved in most instances has not been determined."

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5. Vaughan, W. T.: Practice of Allergy, ed. 2, revised by J. H. Black, St. Louis, C. V. Mosby Company, 1948.

6. Alexander, H. L., and McConnell, F. S.: The Variability of Skin Reactions in Allergy, J. Allergy **2**:23 (Nov.) 1930.

7. Rudolph, J. A., and Cohen, M. B.: Vasomotor Rhinitis with Negative Skin Tests: A Local Nasal Allergy, J. Allergy **5**:476 (July) 1933.

8. Sulzberger, M. B.: Allergy in Dermatology: Critical Review of Some Recent Contributions, J. Allergy **8**:385 (May) 1937.

On discussing the vascular lesions in experimental serum hypersensitivity in rabbits, they suspected that "some host factor in addition to, or separate from, the humoral antibody response may well be operative in the pathogenesis of the vascular lesions of experimental hypersensitivity."

Thus, it would seem that the negative skin reactions cannot be considered as an indication of the patient's true allergic state but serve rather to emphasize the fact that as knowledge of allergy and immunology grows the "routine technics" must be replaced with technics based on consideration of the allergic problems of the individual person. Experimental work has shown that the relationship of the infected area to the area in which the skin tests to determine hypersensitivity are made is an important factor. Evidence has been presented by Rudolph and Cohen [7] indicating that tissue sensitivity to a foreign substance may involve a particular tissue only. This may understandably be the case in otomycosis.

SUMMARY

Of 12 patients suspected of having otomycosis, 4 had species of Aspergillus present in the external auditory canals.

Material from the ears of 4 of 12 patients suspected of having otomycosis yielded pure cultures of Pseudomonas aeruginosa.

These patients showed negative results when given skin tests with antigens consisting of extracts of species of Aspergillus, Penicillium, Alternaria, Hormodendrum and Helminthosporium.

It is emphasized that negative reactions to these skin tests made on the forearm do not indicate the true allergic status of the patient.

The relation between the infected area and the area tested for sensitivity is discussed and more satisfactory sites for testing are noted.

These studies are based on results of cultures for fungi made from material from the ears of 15 allergic patients and of 12 other patients thought to have clinical otomycosis.

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Dr. W. W. Eagle, of Duke Hospital, assisted in this study.

DOUBLE MALIGNANT TUMOR ASSOCIATED WITH PULMONARY TUBERCULOSIS AND ESOPHAGOBRONCHIAL FISTULA

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AND
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A CASE is presented of double primary malignant tumor associated with pulmonary tuberculosis and esophagobronchial fistula. Especially interesting features are the diagnostic possibilities and the role of the otolaryngologist in establishing the diagnoses.

REPORT OF A CASE

A 59 year old white newspaper salesman, unmarried, was admitted to Strong Memorial Hospital on June 24, 1949 with a history of progressively severe chronic cough productive of purulent sputum, which began three months prior to admission. The signs and symptoms were malaise, extreme lassitude, anorexia, undetermined weight loss and vague substernal pain. There was no history of chills, fever, sweats or hemoptysis.

The past history was not of especial significance except that the patient lived the life of a derelict. Routine roentgenograms of the chest made in 1947 showed increased fibrous markings in the pulmonary fields but no evidence of specific disease (fig. 1).

Examination revealed a well developed but chronically ill and emaciated man appearing older than his stated age. The temperature reading was 37.6 C. (99.7 F.). There was a perforation of 1 cm. in the anterior portion of the nasal septum. The mouth contained extremely dirty and carious teeth, coated tongue with slight marginal atrophy and a small whitish patch with surrounding erythema on the anterior part of the tonsillar pillar on the right. The pharynx was slightly injected. There was no cervical lymphadenopathy or enlargement of the thyroid gland. The chest was relatively immobile and moderately increased in anteroposterior diameter. Tactile fremitus was diminished over both apexes. Dulness was present over both apexes, and hyperresonance was noted over the lower pulmonary fields. Scattered coarse rales were heard, and breath sounds were suppressed over the anterior part of the chest on the right. The heart was not enlarged to percussion. The radial pulse rate was 90 per minute. The heart rate and rhythm were regular, and no murmurs were heard. Masses were not palpable in the abdomen. Examinations of the genitalia and the rectum indicated nothing abnormal. Old healed ulcers were seen on the lower part of the legs. Neurologic examination showed the cranial nerves to be intact and the deep tendon reflexes equal and active. Babinski's sign was not elicited. Laboratory studies made on admission indicated that there were 3,720,000 red cells and 22,100 white cells, with 10.5 Gm. of hemoglobin, 90 per

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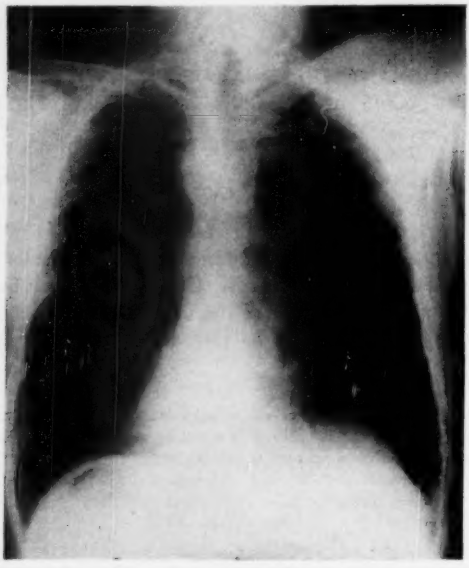

Fig. 1.—Routine roentgenogram of the chest taken in 1947.

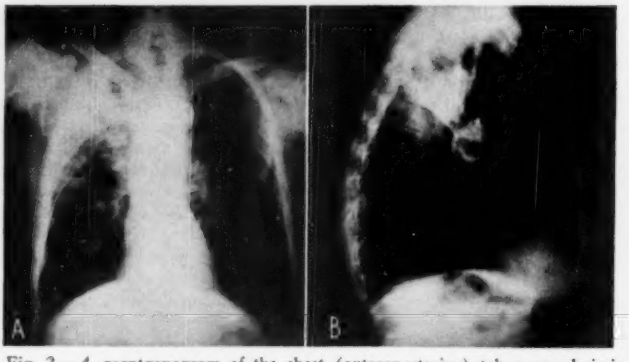

Fig. 2.—*A*, roentgenogram of the chest (anteroposterior) taken on admission, showing density in the upper lobe of the right lung. *B*, lateral roentgenogram with limitation of lesion to upper lobe by interlobar septum.

cent segmented granulocytes, 7 per cent lymphocytes and 3 per cent monocytes. The red cells were slightly microcytic and hypochromic; the number of thrombocytes (platelets) was adequate. The urine had a specific gravity of 1.022 and contained a trace of albumin, no sugar and 5 to 6 white blood cells per high power

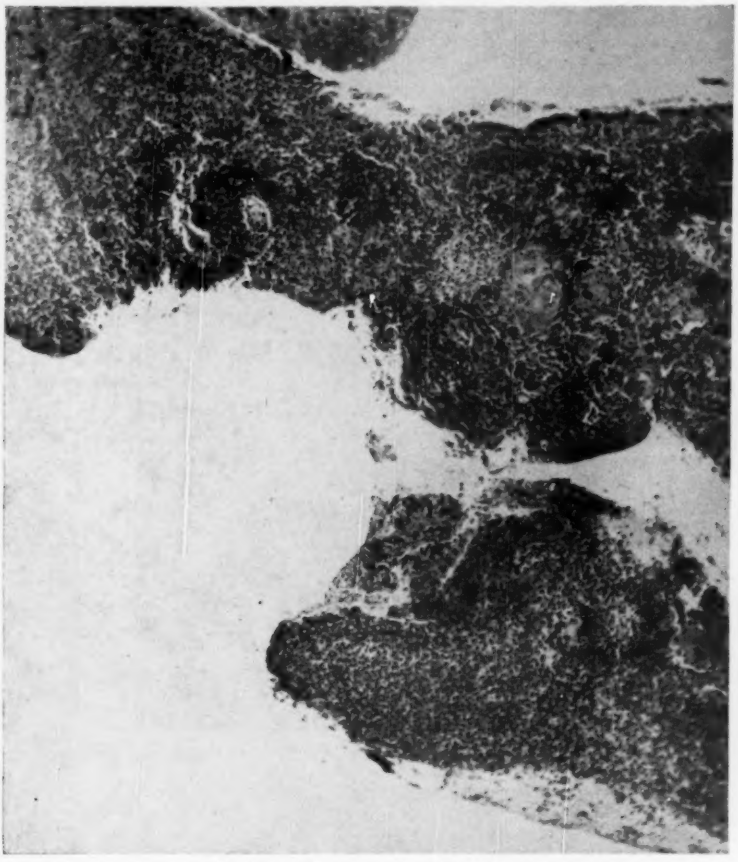

Fig. 3.—Biopsy section from anterior tonsillar pillar (area of change in mucosa is not shown in photograph). × 70.

field and an occasional red blood cell. There were no casts. The guaiac test of the stool indicated no occult blood. Serologic reactions were negative.

With these findings as a basis, the probable diagnosis was active pulmonary tuberculosis. Roentgenograms of the chest taken on June 24 showed a clear left lung field and mediastinum, while in the upper part of the right lung there was a

mottled, increased density with areas of breakdown and two fluid levels suggesting cavity, limited below by the interlobar septum. This picture suggested tuberculosis, with bronchogenic carcinoma as a possibility (fig. 2).

Smears of the sputum on three successive days did not reveal acid-fast organisms. Cultures showed mixed colonies of a hemolytic Hemophilus influenzae, a streptococcus of the viridans group, a beta hemolytic streptococcus and Staphylococcus pyogenes var. albus. Cancer cells (class 4 malignancy) were reported on cytologic examination.

A low grade febrile course persisted, and on July 2 bronchoscopy revealed a moderately broadened and dextrodisplaced carina and free flow of purulent secre-

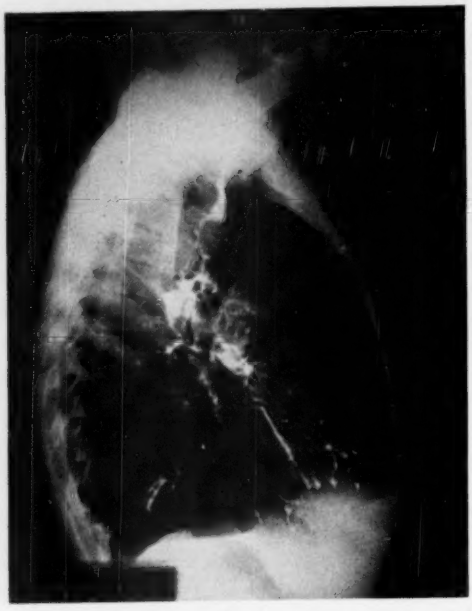

Fig. 4.—Lateral roentgenogram of the chest after a swallow of iodochloral,[9] demonstrating entrance of substance into the bronchi.

tion from the orifice of the upper lobe of the right lung. These bronchial secretions did not contain tubercle bacilli or cancer cells, and culture showed a pure growth of hemolytic Staph. pyogenes aureus. A biopsy specimen from the anterior tonsillar pillar showed changes in the epithelial layer characteristic of intraepithelial epithelioma with infiltration of submucosa by undifferentiated epidermoid carcinoma (fig. 3).

Irradiation of the primary oral neoplasm between July 22 and August 24 produced an apparent complete regression.

The patient received intensive supportive treatment, including transfusions and antibiotics in preparation for contemplated thoracotomy, since the nature of the

thoracic lesion had not been determined and the presence of a malignant growth was strongly suspected.

Unfavorable response with continued debilitation and emaciation marked the course of developments, with one episode on August 19 of sudden elevation in

Fig. 5.—Microscopic section from esophagus showing well differentiated epidermoid carcinoma with pearl formation. × 70.

temperature, 39 C. (100 F.), climaxed by chill. Forty-eight hours later, the cough increased in severity and was aggravated by ingestion of fluids and solids. Examination of the larynx indicated nothing abnormal, and the disturbance was considered to be due to mucositis following irradiation. There was no dysphagia. Under fluoroscopic visualization, a swallow of iodochloral® outlined an annular constriction

in the upper third of the esophagus with pooling below the constriction and entrance into the bronchial radicles. A violent cough ensued, and the oil was refluxed into the trachea (fig. 4). The following morning bronchoesophagoscopy was performed. In addition to the previously noted bronchoscopic findings, a small, irregularly

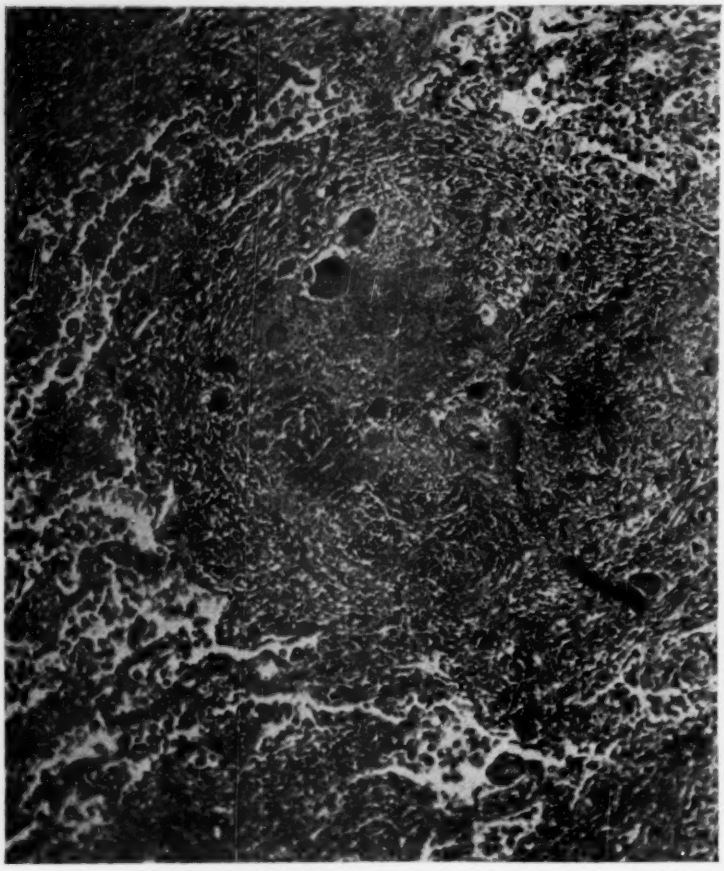

Fig. 6.—Section of lung with typical tuberculous focus. × 70.

shaped fistula was identified on the posterior wall of the left main bronchus immediately below the level of the carina. Esophagoscopy revealed a sessile mass, superficially ulcerated and obstructing the esophagus at the level of the fourth or fifth thoracic vertebra. No definite fistulous opening was noted. Biopsy specimens from the esophagus and the endobronchial fistulous tract were reported as showing

epidermoid carcinoma, with the primary lesion in the esophagus (fig. 5). Bronchial secretions showed on this occasion tubercle bacilli on smear, and tuberculosis was confirmed by culture.

The prognosis was obviously hopeless, but a palliative gastrostomy was performed on August 26. The patient quietly died on September 8.

POSTMORTEM EXAMINATION

The important findings on postmortem examination are summarized as follows. Very dense and firm adhesions fixed the upper portion of the right lung in the thoracic cage, and thick brown necrotic material was contained within the bronchi of the lungs. Immediately below the tracheal bifurcation, a small, irregularly shaped fistula was identified on the posteromedial aspect of the main bronchus on the left. The edges of the fistula were smooth, gray and slightly thickened. The alveolar spaces contained air and fluid. The upper lobe of the right lung was extensively involved, with three very firm areas measuring 2 to 3 cm. each and demonstrating yellow caseous centers on section. Numerous minute gray nodules, 1 mm. or less in diameter, studded the entire lung. Hilar nodes were moderately enlarged, firm and gray on cut surface.

About 5 cm. of the esophagus behind the tracheal bifurcation was replaced by a firm but partially necrotic mass. The lumen of the esophagus above and below opened into the necrotic center of the tumor, which was firmly attached to the periosteum of the vertebrae, aorta and left main bronchus, maintaining fistulous anastomosis.

The general structures and size of the heart as well as the abdominal viscera were not remarkable. There was no evidence of metastasis to any other systems.

MICROSCOPIC EXAMINATION

Both lungs contained many areas of fairly discrete nodules, with centers of caseous necrosis and surrounding fibrosis. There were round cell infiltration, epithelioid cell proliferation and giant cell formation (fig. 6). The bronchi contained a polymorphonuclear exudate with desquamated epithelium. Peribronchial fibrosis and round cell infiltration were seen. Sections of the esophagus showed differentiated epidermoid carcinoma with pearl formation and infiltration into the aortic adventitia. The microscopic changes of all other tissues were consistent with the patient's age and debilitated condition. No evidence of metastasis from either tumor was found.

COMMENT

If the many aspects of this case should receive complete consideration, much more discussion would be necessary than presented. A few points of interest, however, must be mentioned, if only briefly, for a more thorough appreciation of the case.

The differentiation of pulmonary tuberculosis and primary bronchogenic carcinoma can be difficult, and the one may easily simulate the other in clinical characteristics as well as roentgenologically. It is imperative that early diagnosis be made, since the treatments are so dissimilar.[1] Turberculosis may exist with various gradations of malig-

1. Pillsbury, N. R., and Wassersug, J. D.: Differentiation of Bronchogenic Carcinoma and Pulmonary Tuberculosis, New England J. Med. **232**:276-279 (March 8) 1945.

nancy, both in the lung and elsewhere.[2] The position of the otolaryngologist in these cases is important particularly in establishing diagnosis. This is especially true in tuberculosis and in pulmonary tumors, since bronchoscopy is often the differentiating method of examination. The importance of bronchoesophagoscopy in establishing positive diagnosis cannot be too strongly emphasized and no examination of the chest or upper food passages is complete unless this procedure has been included.

In our experience the routine examination of bronchial secretions bacteriologically and cytologically has proved most helpful. Each specimen is studied by smear, culture and guinea pig inoculation for acid-fast organisms and, occasionally, when the diagnosis has not otherwise been made, the answer is obtained. Likewise, the routine cytologic examination of the bronchoscopically aspirated secretions has been an adjunct in the diagnosis of carcinoma of the lung. The presence of atypical or malignant cells should initiate a search for the lesion, and in this case the early malignant neoplasm in the mouth was discovered through just such an endeavor.

Many reports on multiple primary malignant tumors are to be found in the literature, but none have appeared for the past ten years in the American journals of otolaryngology.

Since one of the multiple tumors of reported series frequently is located in the mouth, bronchi and esophagus, the problem of multiple malignant growths is of interest to the otolaryngologist. In only a few of the reported cases were there two or more primary tumors in sites where they might be diagnosed by an otolaryngologist, adding interest to our case. However, one must be ever alert for a second primary growth in a patient known to have or to have had a carcinoma, as the incidence of multiple primary tumor is many times (estimated up to 15 times[3]) greater than the expected incidence.

From 2 to 4 persons in every 100 cases of malignant growth may be expected to have another primary malignant tumor.[4] Gordon [5] suggested that more cases of multiple primary malignant growths probably would be found if a very careful search were made in all autopsies of persons with malignant tumor.

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2. Cooper, F. G.: The Association of Tuberculosis and Carcinoma, Am. Rev. Tuberc. **25**:108-147 (Jan.) 1932.

3. Lund, C. C.: Second Primary Cancer in Cases of Cancer of the Buccal Mucosa, New England J. Med. **209**:1144-1152 (Dec. 7) 1933.

4. Hurt, H. H., and Broders, A. C.: Multiple Primary Malignant Neoplasms, J. Lab. & Clin. Med. **18**:765-777 (April) 1933. Hanlon, F. R.: Multiple Primary Carcinomas, Am. J. Cancer **15**:2001-2012 (July) 1931.

5. Gordon, B. S.: Triple Synchronous Primary Carcinoma, Arch. Path. **45**:56-64 (Jan.) 1948.

The problem assumes even greater significance when one attempts to distinguish between a metastatic and a primary lesion. The prognosis is poor when metastasis has occurred or with recurrence, but it is as good for the second as the first primary tumor with proper treatment.[5] Successful treatment of patients with two or more malignant tumors [6] gives incentive to early diagnosis and treatment. Since in many of the cases the multiple primary tumors are in the same organ, such as the gastrointestinal tract, attention should be directed especially to the organ system with a malignant growth. Criteria for the diagnosis of separate primary tumors varies somewhat, but those established by Warren and Gates [7] seem generally accepted. These criteria are that the tumors must be distinct and show definite changes of malignancy, and the probability that one is metastatic is ruled out.

In the present case, having begun as a primary lesion in the esophagus, the carcinoma had established fistulous communication with the bronchus. Dysphagia is frequently the earliest symptom of such a lesion, but in this case it was never present, and cough aggravated by ingestion of liquids and solids was the initial symptom. According to Clagett and associates [8] acquired esophagotracheobronchial fistulas are oftenest caused by cancerous changes.

SUMMARY

A case is reported of primary carcinoma of the mouth and esophagus with associated pulmonary tuberculosis and esophagobronchial fistula.

Bronchiogenic carcinoma and pulmonary tuberculosis may simulate each other, and bronchoscopy may be the differentiating method of examination.

Between 2 and 4 per cent of patients with malignant growths may have another primary lesion.

A malignant growth is the commonest cause of acquired esophagotracheobronchial fistula.

6. Holland, C. A.: Multiple Carcinomas, J. A. M. A. **128**:356-359 (June 2) 1945. Lichtman, A. L.: Multiple Primary Malignant Lesions, Proc. Staff Meet., Mayo Clin. **19**:317-323 (June 14) 1944.

7. Warren, S., and Gates, O.: Multiple Primary Malignant Tumors, Am. J. Cancer **16**:1358-1414 (Nov.) 1932.

8. Clagett, O. T.: Payne, J. H., and Moersch, H. J.: Acquired Esophagotracheobronchial Fistula, Surg., Gynec. & Obst. **82**:87-90 (Jan.) 1946.

TUMORS OF THE FACE

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DETROIT

THE PURPOSE of this paper is to consider the factors involved in the diagnosis and treatment of tumors of the face. Inflammatory tumors and cysts as well as neoplastic tumors are included. The information obtained from a study of 339 patients that have been operated on by me personally, between Jan. 1, 1940 and July 1, 1949, inclusive, has been used whenever it was thought to be of value. The tissues in question were examined microscopically in each case except those of senile keratosis and nevi in which the diagnosis was obvious and electrocoagulation was done without first removing tissue.

The ordinary mole, or nevus, is the commonest neoplasm that is encountered and usually the least important. However, Webster, Stevenson and Stout [1] expressed the belief that a significant number of malignant melanomas start from moles. They stated that trauma is an important factor in this. An editorial in *The Journal of the American Medical Association* [2] emphasized this point and urged complete removal if the mole is to be disturbed at all.

Patients seeking advice with regard to nevi only because of fear of cancer are usually reassured and the nevus is not disturbed. Such tumors are so common and cancerous change so infrequent that it is considered unnecessary to remove them for that reason.

Removal is advised if requested for cosmetic reasons or by men because of difficulty in shaving.

If the base of the growth is broad, total excision is usually done, and if the base is narrow or if the skin is thick, as on the nose and chin, electrocoagulation may be preferred. In either case, removal should be complete.

Microscopic examination is always desirable, but especially so if there is any doubt about the diagnosis. This condition does not preclude

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Candidate's thesis presented in partial fulfilment of the requirements for membership in the American Laryngological, Rhinological and Otological Society, Inc.

1. Webster, J. P.; Stevenson, T. W., and Stout, A. P.: Symposium on Reparative Surgery: The Surgical Treatment of Malignant Melanomas of the Skin, S. Clin. North America **24**:319 (April) 1944.

2. Cancerous Melanoma, editorial, J. A. M. A. **139**:1151 (April 23) 1949.

use of the cautery, for the tumor can be excised and the base then electrocoagulated.

In microscopic examination tumors of this type are usually reported as pigmented nevi, benign melanomas or seborrheic papillomas or warts.

Keratoses and hyperkeratoses are precancerous and handled in much the same way. Superficial electrocoagulation will eradicate most of them.

TABLE 1.—*Distribution of Tumors*

Types	Number of Cases	
Benign Tumors		
Nevi	82	
Papillomas	43	
Keratoses	31	
Sebaceous cysts	54	
Epidermoid cysts	5	
Dermoid cysts	1	
Hemangiomas	4	
Lymphangiomas	1	
Lipomas	2	
Fibrolipomas	1	
Chondromas	1	
Rhinophymas	1	
Adenomas of sebaceous glands	1	
Tuberculoma	1	
Neurofibromas	2	
Sarcoidosis (Boeck's sarcoid)	1	
Syringocystoma	1	
Molluscum contagiosum	1	
Cyst of the parotid gland	2	
Xanthoma	1	
Granuloma pyogenicum	1	
Preauricular sinuses	7	
Total	244	
Malignant Tumors		
Basal cell epitheliomas	69	
Squamous cell epitheliomas	19	
Mixed basal and squamous cell epitheliomas	1	
Malignant melanomas	3	
Adenocarcinoma (includes mixed tumors of the parotid gland)	9	
Hemangioendothelioma	1	
Total	96	
Total benign and malignant tumors		339

Some pigmented nevi seen in this series extended over a large area and had hairs growing from them. Several nevi were so large that it was necessary to remove them in two or more stages. One covered so large an area that it was necessary to apply a free split thickness skin graft.

Xanthomas on the eyelids are important chiefly from a cosmetic view. Because they tend to increase in size, it is desirable to remove them while they are small and while there is ample skin to close the wound. When much of the skin of the lid is involved, it may be necessary to cover the area with a free graft after removal.

Small chondromas occur on the ear, and since they may be associated with hyperkeratosis, their removal is desirable.

Neurofibromas may occur wherever there is nerve tissue, and they present no particular problem on the face in cases in which simple excision is usually sufficient.

Lipomas are soft and movable and easily excised.

Fibrolipomas involving the face are rare. There is 1 case in this series that has been reported in detail.[3] The patient had a large fibrolipoma involving the right side of the face. This tumor was very vascular but was removed surgically. A thorough search of the literature revealed only 1 such case, and in that one the growth involved the oral side of the cheek.[4]

Most writers[5] described rhinophyma as a hyperplastic form of acne rosacea which appears on the nose and occasionally extends to the cheek. Since paring down the growth to the proper level is followed by regeneration of the epithelial covering, this is thought to be the best method of treatment. It is thought that the covering regenerates from remnants of the enlarged sebaceous glands. The use of flaps consisting of skin of the growth or a free skin graft is considered less satisfactory.

There was 1 case of rhinophyma in this series which was treated by shaving the lesion down to the proper level with a safety razor blade held in a hemostat and then applying gauze dressing of petrolatum U. S. P. In twelve days epithelization was complete (fig. 1).

There were only 4 cases of hemangioma in this series, partly because irradiation is the treatment of choice in children and no tissue was available for microscopic examination. Irradiation may be applied by use of roentgen rays, radium element or radon seeds, depending on the location and degree of involvement of the skin. If the lesion is superficial and the skin heavily involved, roentgen ray treatment is satisfactory. If, however, the tumor is deeper and the skin over it relatively normal, the insertion of radon seeds around the periphery is the method of choice. I have recently treated successfully a cavernous hemangioma 1 cm. in diameter on the forehead of a child by the insertion of four ¼ millicurie gold radon seeds around the periphery.

The so-called port-wine lesions are superficial and do not respond well to irradiation. These are treated best by excision.

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3. Weaver, D. F.: Fibrolipoma of the Face, Ann. Otol., Rhin. & Laryng. **55**:196 (March) 1946.

4. Mena, R.: Fibro-lipoma del carrillo, Arch. cubanos cancerol. **3**:102 (April-June) 1944.

5. Barsky, A. J.: Plastic Surgery, Philadelphia, W. B. Saunders Company, 1938. Knowles, F. C.: Diseases of the Skin, Including the Acute Eruptive Fevers, ed. 2, Philadelphia, Lea & Febiger, 1923.

Although reports indicate that certain hemangiomas disappear spontaneously, this tendency is not consistent enough to justify postponing treatment. The fact that these tumors are frequently seen in adults confirms this policy. Since radiosensitivity of such tumors decreases as the patient grows older, irradiation is of little value in adults.

In general, if the lesion is superficial and of the capillary type, it should be excised and the wound closed if possible. If the lesion covers a large area, free skin grafting may be necessary. In most cases the graft could be applied immediately. If, however, the subcutaneous tissue is involved and vascularity is marked, it may be necessary to electrocoagulate the denuded area and wait several weeks until granulations

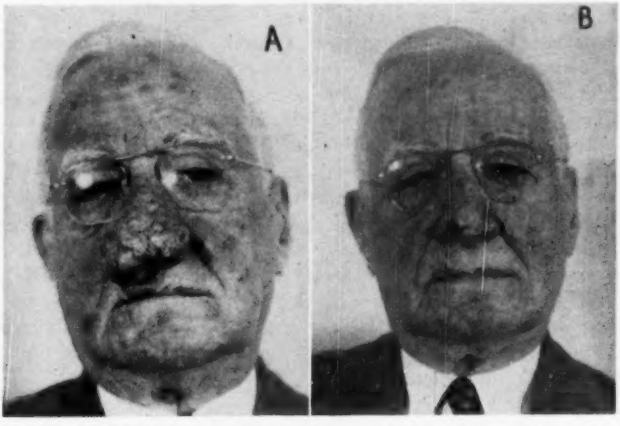

Fig. 1.—*A*, rhinophyma. *B*, appearance two weeks after the growth was shaved with a razor blade.

have developed before applying the graft. Conway [6] found tattooing to be of value in selected cases.

If the lesion is deep and of the cavernous type, injection of sclerosing material, such as sodium morrhuate solution or sylnasol® (5 per cent solution of the sodium salts of certain of the fatty acids of psyllium seed oil with 2 per cent benzyl alcohol) is an excellent method of treatment. This procedure is done in stages. Since the material that is injected may be lost in the general circulation if injected directly into a vessel, it may be advisable to inject into tissue outside the vessel.

6. Conway, H.: Evolution of Treatment of Capillary Hemangiomas of the Face with Further Observation on the Value of Camouflage by Permanent Pigment Injection (Tattooing), Surgery **23**:389 (March) 1948.

Figi [7] described a method of treating lesions of this type by electrocoagulation. An electrode is used which is protected throughout with insulation except for several millimeters at the tip. The tip is inserted through the skin over the tumor.

Occasionally, it is possible to remove a cavernous hemangioma surgically. There is 1 such case in this series, which is reported elsewhere in detail.[8] A pulsating cavernous hemangioma of the external ear was removed surgically after ligation of the superficial temporal and posterior auricular arteries and veins. Faleeva [9] reported a similar case in which improvement followed ligation of the external carotid artery.

Although it was not included in this series because there was no tissue for microscopic examination, 1 patient with hereditary hemorrhagic telangiectasia had been treated. The patient had been having nasal hemorrhages for years. Her father and brother had died from recurrent nasal hemorrhages. There were numerous small areas of telangiectasia on the face (*fig. 2*). These lesions as well as similar ones on the nasal septum were treated by electrocoagulation. The use of rutin was a useful adjunct in the treatment in this case.

There was a young boy in this series with a lymphangioma which involved the parotid region. It was removed through an incision in the preauricular region. Microscopically, it had the appearance of cystic hygroma. The patient was free from symptoms for several years, and then secondary removal for a recurrence was necessary.

Figi [10] reported 13 cases of cystic hygroma, all of which, however, were primary in the neck. Six of these extended into the parotid region. In Watson and McCarthy's [11] series of 14 cases none of the growths was confined to the face.

There was 1 case in this series of hemangioendothelioma involving the upper lip. The tumor was excised and the postoperative area treated with roentgen rays. There is no evidence of recurrence fifteen months later.

Erich [12] published an interesting article on sebaceous, mucous, dermoid and epidermoid cysts. He discussed the pathologic differentia-

7. Figi, F. A.: Treatment of Angioma of the Face, Arch. Otolaryng. **24**:271 (Sept.) 1936.

8. Weaver, D. F.: Three Unusual Cases of Hemangioma, Ann. Otol., Rhin. & Laryng. **52**:507 (June) 1943.

9. Faleeva, V. L.: Case of Pulsating Angioma Racemosum of the Auricle, Zhur. ush. nos. i gorl. bolez. **16**:264, 1939.

10. Figi, F. A.: Radium in the Treatment of Multilocular Lymph Cysts of the Neck in Children, Am. J. Roentgenol. **21**:473 (May) 1929.

11. Watson, W. L., and McCarthy, W. D.: Blood and Lymph Vessel Tumors: Report of 1,056 Cases, Surg., Gynec. & Obst. **71**:569 (Nov.) 1940.

12. Erich, J. B.: Sebaceous, Mucous, Dermoid and Epidermoid Cysts, Am. J. Surg. **50**:672 (Dec.) 1940.

tion of sebaceous cysts and keratomas and pointed out that occasionally a sebaceous cyst will develop into a squamous cell epithelioma. Peden [13] found 14 cases of squamous cell epithelioma in 832 cases of sebaceous cyst, an incidence of 1.7 per cent. For this reason, and because the cysts are prone to become infected, surgical removal is usually indicated. When the cysts have become infected, incision and drainage are effected and the cyst is removed approximately three weeks later.

Fig. 2.—Hereditary hemorrhagic telangiectasia.

In this series there were 54 sebaceous cysts, 5 epidermoid and 1 dermoid cyst. So far as I know, there has been no recurrence of any of these. There has been no case of involvement by squamous cell epithelioma, although 1 sebaceous cyst was associated with a basal cell epithelioma.

13. Peden, J. C., Jr.: Carcinoma Developing in Sebaceous Cysts, Ann. Surg. **128**:1136 (Dec.) 1948.

Havens [14] described a method of infiltrating such cysts with procaine hydrochloride U. S. P. (novocain®). This procedure facilitates their removal. The needle is inserted, with the bevel down, between the skin and the cyst wall. This method tends to produce infiltration around the cyst, freeing it from the surrounding tissue.

One patient was referred for removal of a tuberculous tumor of the forehead which had recurred following surgical removal. It involved the skin and periosteum of the frontal region on the right. The lesion was thoroughly electrocoagulated and covered six months later by a pedicled flap from the forehead. The donor area was covered by a free split thickness skin graft.

A firm tumor which had the consistency of a sebaceous cyst was removed from the helix of the right ear of an elderly woman. The cyst proved to be sarcoidosis (Boeck's sarcoid). No evidence of the disease could be demonstrated elsewhere in the patient.

In 1943, Dill [15] reviewed the literature and reported a case of rhinoscleroma in which there was involvement of the upper lip and nasal septum. The diagnosis was made microscopically, and roentgen ray therapy was used. Four years later there was no evidence of recurrence of the tumor.

While asymptomatic preauricular sinuses are rather common, those requiring surgical removal are relatively rare. Small groups of such cases are reported from time to time.[16]

When treatment is indicated because of troublesome drainage or the development of a cyst, surgical excision, after the injection of methylene blue, seems to be satisfactory. However, when infection has resulted in abscess formation and drainage through a resulting skin fistula, electrocoagulation of the various tracts, as suggested by Havens,[17] seems to have an advantage. Although certain of these lesions are small and easily removed, some are extensive and deep. There were 7 preauricular sinuses in this series.

Keloids are best treated by surgical removal, followed by roentgen ray treatment as soon as the wound has healed. At times, slight trauma,

14. Havens, F. Z.: Removal of Calculi from the Submaxillary Ducts: A Trick in Tying a Knot; A Simplified Method of Local Anesthesia for Removal of Keratomas and Sebaceous Cysts, S. Clin. North America **15**:1227 (Oct.) 1935.

15. Dill, J. L.: Rhinoscleroma: Report of One Case, Ann. Otol., Rhin. & Laryng. **52**:496 (June) 1943.

16. Pastore, P. N., and Erich, J. B.: Congenital Preauricular Cysts and Fistulas, Arch. Otolaryng. **36**:120 (July) 1942. Penick, R. M., Jr.: Preauricular Sinuses: Diagnosis and Treatment, South. M. J. **38**:103 (Feb.) 1945. Weaver, D. F.: Congenital Preauricular Sinuses, Laryngoscope **56**:246 (May) 1946.

17. Havens, F. Z.: Congenital Branchiogenic Preauricular Sinus: Note Regarding Its Treatment, Arch. Otolaryng. **29**:985 (June) 1939.

such as piercing the ears for earrings, results in rather extensive formation of keloids in people who have this tendency.[18]

Actinomycosis is a slowly developing inflammatory condition. The diagnosis is made by demonstrating the presence of fungus in pus from a freshly opened abscess. While irradiation and the use of iodides in large doses have been used in the past, more recently, streptomycin and penicillin have been used.

The possibility of mumps should always be considered when there is acute swelling of the salivary glands. The use of diethylstilbestrol U. S. P. as a prophylactic and therapeutic agent in the treatment of mumps orchitis has recently been recommended by Hoyne, Diamond and Christian.[19]

In 1933, New and Kirch [20] described a condition of unknown cause characterized by permanent enlargement of the lips and face following recurring attacks of acute swelling. Treatment by injection of boiling water and irradiation gave satisfactory results. Six months after treatment there was no recurrence of the condition; plastic removal of excess tissue was carried out. Their report was based on a study of 67 cases.

Certain conditions which affect the bones of the face, such as osteitis, fibrosa cystica and osteitis deformans (Paget's disease), may indicate operative removal of excess bone for cosmetic purposes.

Most cancers of the face do not recur after simple excision or electrocoagulation; however, when they are highly malignant or advanced, the mortality and morbidity rate may be high. Irradiation may effect a cure in certain cases of basal cell epithelioma. Irradiation is most effective in tumors which have not been infected, which have not been treated previously and which do not involve perichondrium or periosteum. However, when one adds to these conditions the fact that microscopic examination is necessary and that the scar following excision may be almost invisible, it seems that surgical removal usually should be the method of choice. An exception to this may be the occasional instance when a competent surgeon is not available. It is seldom that a patient's general condition would contraindicate the minor operation that is usually entailed.

Basal cell epitheliomas arise from the basal layer of the epithelium. They are slow-growing, do not metastasize and when completely

18. Weaver, D. F.: Keloid Formation of Both Ear Lobes: Case Report, Arch. Otolaryng. **44**:212 (Aug.) 1946.

19. Hoyne, A. L.; Diamond, J. H., and Christian, J. R.: Diethylstilbestrol in Mumps Orchitis: Prophylactic and Therapeutic Use, J. A. M. A. **140**:662 (June 25) 1949.

20. New, G. B., and Kirch, W. A.: Permanent Enlargement of the Lips and Face, J. A. M. A. **100**:1230 (April 22) 1933.

removed seldom recur. De Cholnoky [21] found that 227 of 229 basal cell epitheliomas (99 per cent) which had been excised as a primary lesion had not recurred five years later. He recommended surgical excision in most cases.

Macomber and Paletta [22] recommended wide excision of all malignant tumors of the skin. Their report was based on a study of 200 patients with malignant tumors of the skin; 92 per cent of the tumors were on the face.

An interesting experiment was reported by Amersbach, Walter and Sperti.[23] They treated 21 patients with basal cell epitheliomas by infiltrating the lesion with spleen or liver extract; in 14 the lesion regressed completely and disappeared; in 6 it showed regression, but the patients were still under treatment, and in 1 it did not regress. Final evaluation of this procedure is not yet possible.

When these tumors have recurred after irradiation, when infection is present or when the underlying perichondrium or periosteum is involved, complete removal of the tumor is much more difficult. Further irradiation at this time is seldom of value and tends to waste valuable time. Surgical excision may be difficult, owing to hemorrhage and the necessity for removing bone. Electrocoagulation is a most satisfactory method of destroying the tumor at this stage. A slough separates in several weeks, and when bone is electrocoagulated, sequestrum usually separates in about two months. When the mastoid bone is involved, the time required for the separation of a sequestrum is much longer.

The possibility of grafting tumor cells when the cold knife is used is eliminated when the cautery is used.

Although one should not unnecessarily mutilate the area, complete destruction of the tumor should be given first consideration. After a period of three to twelve months has passed without evidence of recurrence of the tumor, suitable reconstructive procedures can be carried out.

In this series of cases, there are 62 patients who have been operated on for basal cell epithelioma. One patient had three separate tumors; 2 patients had two separate tumors; in 1 patient another tumor developed in another location at a later date. Of the 10 patients that were operated on before 1945, 9 are free from recurrence at the present time. The tenth patient had an extensive tumor of ten years' duration that had received irradiation before I first saw it. The malar bone

21. de Cholnoky, T.: Cancer of the Face, Ann. Surg. **122**:88 (July) 1945.

22. Macomber, W. B., and Paletta, F. X.: Malignant Tumors of the Skin in Military Personnel, Plast. & Reconstruct. Surg. **2**:234 (May) 1947.

23. Amersbach, J. C.; Walter, E. M., and Sperti, G. S.: Treatment of Basal Cell Epitheliomas by Injection of Tissue Extracts, Arch. Dermat. & Syph. **54**:119 (Aug.) 1946.

was exposed, and the eyelids, temporal region and maxillary antrum were involved. After removal of the eye, removal of the malar bone and thorough electrocoagulation of the tumor, he was free from symptoms for a number of months; but the tumor recurred and several more operations were necessary. Complete eradication of the tumor was not accomplished. The patient's condition at present is not known.

Of the 52 patients operated on since Jan. 1, 1945, 50 are free from recurrence at present; follow-up treatment has been unsuccessful in 1 patient, and the tumor in 1 has recurred. In the last-mentioned patient, the tumor involved the left ear and mastoid and had been heavily irradiated. Simple mastoidectomy and electrocoagulation were done, and the patient was free from recurrence for about four years, but the tumor has recently recurred.

TABLE 2.—*Follow-Up Data on Basal Cell Epithelioma*

Treatment Date	Number of Cases
Before Jan. 1, 1945	10
After Jan. 1, 1945	52
Total	62
Before Jan. 1, 1945	
Without recurrence	9
With recurrence	1
Total	10
After Jan. 1, 1945	
Without recurrence now	50
With recurrence	1
No follow-up observation	1
Total	52

The small lesions in the group just described were excised unless the underlying perichondrium or periosteum were thought to be involved. In such instances electrocoagulation was used and the wound left open. The resulting scar is usually about one-third as large as the original wound.

In 14 cases plastic procedures were performed. In case 1, the scar resulting from the electrocoagulation of a tumor on the nose was excised several years later. In case 2 an immediate plastic procedure was carried out on the external ear after the removal and electrocoagulation of a tumor. In cases 3, 4, and 5 a free split thickness skin graft was applied immediately after removal of the tumor. One of these cases was reported in detail previously.[24]

In case 6 electrocoagulation was carried out for a tumor of the ear and postauricular region. Three weeks later a free split thickness skin

24. Weaver, D. F.: Free Skin Grafts and Pedicle Flaps in the Treatment of Recurring Basal Cell Epitheliomas: Case Reports, Laryngoscope **53**:336 (May) 1943.

graft was applied to the granulating area. This case was reported in detail previously.[34]

In case 7 a tumor was present on each lower eyelid. The smaller one was deep and involved the tarsal plate. This tumor was electrocoagulated and a free split thickness skin graft applied at a later date. The larger tumor was superficial, and an immediate free split thickness skin graft was applied after removal. There was a third and smaller tumor below the right eye (fig. 3).

In case 8, a tumor involving the scalp and outer plate of the skull had been present for a number of years. Irradiation had been used without improvement. The tumor was thoroughly electrocoagulated.

Fig. 3.—*A*, multiple basal cell epitheliomas. *B*, appearance after removal and grafting.

Two months later a sequestrum was removed and the area covered with a pedicled flap from the scalp. The donor area was covered by a free split thickness skin graft from the thigh. Three years later there is no evidence of recurrence.

In case 9 a tumor involved the supraorbital ridge and upper lid. Excision and irradiation had been carried out when the patient was first seen. The tumor was destroyed by electrocoagulation. Two months later a sequestrum, which included the supraorbital ridge, was removed without perforation of the lining membrane of the frontal sinus. An adjacent transverse flap from the forehead, with a pedicle at each end, was brought over the defect. After the skin of the upper lid and the skin above was undermined, the wound was closed.

In case 10 the lesion followed a burn from hot metal. When the patient was first seen, excision had been attempted several times and intensive irradiation had been used. The periosteum of the frontal bone was involved; electrocoagulation was again used. The entire outer plate of the right frontal sinus was removed as a sequestrum about two months later. The defect was covered with a pedicled flap from the forehead, and the donor area was covered with a free split thickness skin graft. The residual sinus cavity became filled with fibrous tissue from the raw surface of the flap. The patient has remained free from recurrence for eight years. This case was reported in detail previously.[24]

In case 11, when the patient was first seen, a tumor had previously been operated on, a skin graft applied and irradiation used. There was

Fig. 4.—*A*, postoperated and irradiated recurring basal cell epithelioma. *B*, appearance after electrocoagulation. *C*, postoperative appearance.

a recurrence of the tumor which involved the right temporal region, the right eyebrow and the right half of the upper lid (fig. 4, *A*). Thorough electrocoagulation was carried out (fig. 4, *B*). Several months later a sequestrum was removed and the area covered by a pedicled graft from the forehead after preliminary elevation. The donor area was covered by a free split thickness skin graft. Several months later the upper lid was reconstructed by using a small pedicled flap from the edge of the larger flap (fig. 4, *C*).

In case 12 there was involvement of the skin by the tumor, and a fistula into the left antrum was present. Several operations had been performed and irradiation had been used over a ten year period. The recurrence was thoroughly electrocoagulated, and after freedom from recurrence for a year, the defect was covered by a lined pedicled flap

from the forehead, after preliminary elevations. Seven years later there is no evidence of recurrence. This case was reported in detail previously.[25]

In case 13 a defect about 2 cm. in diameter on the right side of the nose was covered by a pedicled flap from the forehead. The pedicle was in the right supraorbital region. The donor area was covered by a free split thickness skin graft.

In case 14, a 54 year old woman had a tumor involving the dorsum of the nose, the upper part of the nasal septum and the upper lateral nasal cartilages (fig. 5, *A*). Several months after electrocoagulation, further electrocoagulation was necessary for recurrence (fig. 5, *B*). Seven months later, when there had been no further recurrence, a sickle-shaped pedicled flap from the forehead and scalp was elevated. This procedure was first described by New.[26] The distal end was lined with a free split thickness skin graft from the upper arm. In subsequent stages the flap was cut across at its distal end, first elevated throughout two thirds of its extent, then throughout its entire extent, and then transferred to the nose. The lining was sutured to the nasal mucous membrane. A free split thickness skin graft was applied to the scalp (fig. 5, *C*). After three weeks, it was cut partially across, and one week later it was cut completely across and returned to the forehead (fig. 5, *D*).

One patient whose entire nose was destroyed by electrocoagulation of a large tumor was free from recurrence for five years. An active pulmonary tuberculosis has prevented reconstruction of the nose. This case was reported previously in detail.[25]

Squamous cell epitheliomas are much less common on the face than basal cell epitheliomas. They cause death oftener because the more active ones tend to metastasize. There is a definite relation between prognosis and the microscopic grading of these tumors. The low grade, well differentiated tumors have a better prognosis than the high grade, undifferentiated ones.

Squamous cell epitheliomas of low grade malignancy are handled in much the same way as basal cell epitheliomas, since they do not readily metastasize. The more actively malignant tumors are best handled by a combination of surgical removal and irradiation. With the exception of tumors of the lower lip, removal of the lymphatic glands of the neck is usually not indicated in squamous cell epitheliomas of the face. This is true because they do not readily metastasize, and when they do, inaccessible glands are apt to be involved.

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25. Weaver, D. F.: Advanced Carcinomata of the Face, Ann. Otol., Rhin. & Laryng. **55**:932 (Dec.) 1946.

26. New, G. B.: Sickle Flap for Nasal Reconstruction, Surg., Gynec. & Obst. **80**:497 (May) 1945.

Fig. 5.—*A*, basal cell epithelioma involving upper edge of septum and upper lateral nasal cartilages. *B*, appearance after electrocoagulation. *C*, pedicled flap attached to defect. *D*, postoperative appearance.

Epitheliomas of the lower lip metastasize to the cervical lymphatic glands in a significant number of cases. Although there is a difference of opinion among surgeons about the necessity for removal of these glands before they become obviously involved, Erich stated the opinion that most patients with such a tumor should have removal of the local lesion followed by dissection of the submental glands and the submaxillary and upper deep cervical glands on both sides. If invasion of the glands by tumor can be demonstrated, a block dissection is carried out on the involved side.

Fig. 6.—Appearance after removal of mixed basal and squamous cell epithelioma. A free graft has been applied.

In this series there are 19 patients who have been operated on for squamous cell epitheliomas. Of the 5 patients that were operated on before 1945, 3 were free from recurrence after five years. The fourth patient died of an intercurrent disease. The fifth patient had numerous epitheliomas of grade 2, which had developed on an area of radiodermatitis (fig. 6). These growths were electrocoagulated, and four years later there was no recurrence on the face, but the same type of tumor developed in the oral cavity. This recurrence was thought to be secondary to the tumors of the face.

Of the 14 patients operated on since the beginning of 1945, 9 are alive and without recurrence and 5 have died of tumor.

One of the patients who died had a grade 2 squamous cell epithelioma of the columella and anterior end of the nasal septum. This tumor had been badly neglected, being treated with ultraviolet light for about eight months. When the patient was first seen there was evident metastasis to the submaxillary glands on both sides. Electrocoagulation of the local lesion, followed by bilateral block dissection of the neck in stages, was carried out. The patient died after a recurrence of the lesion, which involved the base of the skull. This case has been reported previously in detail.[25]

A second patient was seen recently with the same type of lesion in the same location but without cervical metastases. The local lesion was

TABLE 3.—*Follow-Up Data on Squamous Cell Epithelioma*

Treatment Date	Number of Cases
Before Jan. 1, 1945	5
After Jan. 1, 1945	14
Total	19
Before Jan. 1, 1945	
Without recurrence now	3
With recurrence	1
Death from intercurrent disease	1
Total	5
After Jan. 1, 1945	
Without recurrence now	9
Deaths	5
Total	14

electrocoagulated, and in view of the experience with the aforementioned case and the fact that anatomically that area drains to the cervical glands, neck dissection was carried out. The submaxillary and upper deep cervical glands from both sides and the submental glands were removed.

Three of the deaths occurred in those cases with involvement of the ears. De Cholnoky [21] found a high mortality rate in patients with involvement of the ears.

There was only 1 case in which a plastic procedure was required. The patient had a grade 2 lesion involving the left brow and frontal sinus. It had been operated on and irradiated when first seen. Thorough electrocoagulation was carried out. Several months later the entire outer plate of the frontal sinus was removed as a sequestrum. About a year later the defect was covered by a flap from the forehead, with the pedicle in the left temporal region. The donor area was covered by a free split thickness skin graft (fig. 7).

One patient in this series had a mixed basal cell and squamous cell epithelioma in the right temporal region. This lesion was excised, and

Fig. 7.—*A*, appearance after electrocoagulation for recurring squamous cell epithelioma. *B*, the defect covered by a pedicled graft.

Fig. 8.—Multiple squamous cell epitheliomas, associated with radiodermatitis.

examination of frozen sections indicated there was a sufficient margin of normal tissue around and beneath it. A free split thickness skin graft was applied immediately (fig. 8).

Webster, Stevenson and Stout [1] reported a study of 162 malignant melanomas which had been operated on over a thirty-five year period. Thirty-two of these growths were on the face and 1 on the scalp. In 68 cases a mole preceded the melanoma, and in 36 there was a history of trauma. They recommended radical surgery for this highly malignant tumor.

There were 3 patients in this series with malignant melanomas. The tumor in all cases appeared brown in color. A 33 year old woman (case 1) had a lesion in the left preauricular region, 2.5 cm. in diameter, and with the typical appearance of melanoma. The lesion was excised widely, and then thorough electrocoagulation was done. The pathologic diagnosis was malignant melanoepithelioma. The patient died three years later.

A 53 year old man (case 2) had a lesion on the left cheek 1.5 cm. in diameter. It was widely excised and the wound closed. The pathologic diagnosis was malignant melanoepithelioma. The patient is free from recurrence one year later.

A 62 year old woman (case 3) had a lesion in the right cheek 2 cm. in diameter. It had been present ten years but had grown rapidly in the past year or two (fig. 9, *A*). The lesion was excised widely and the area covered immediately by a pedicled skin flap from the lower lip (fig. 9, *B*). The pathologic diagnosis was malignant melanoma, sarcomatoid spindle cell type. The patient is alive and without evidence of recurrence twenty-seven months later.

In this series, the diagnosis of cystic hydroadenocarcinoma was made once. This tumor, removed from the left cheek of an elderly man, felt firm and was considered a sebaceous cyst. Sufficient time has not elapsed since removal to determine the outcome.

A tumor 1 cm. in diameter was removed from the bregma of a young man, and a microscopic diagnosis of mixed tumor was made.

Some surgeons and pathologists consider the so-called mixed tumors of the salivary glands to be low grade adenocarcinomas. It is felt that complete removal of these tumors, without tearing the capsule, results in cures in a high per cent of cases. However, when the adenocarcinoma is of a higher grade of malignancy or when the cylindroma type of tumor, as mentioned by Dockerty and Mayo,[27] is present, more radical removal is necessary.

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27. Dockerty, M. B., and Mayo C. W.: Primary Malignant Tumors of the Submaxillary Gland with Special Reference to Mixed Tumors, Proc. Staff Meet., Mayo Clin. **17**:593 (Dec. 16) 1942.

In this series there were 10 patients with tumors of the parotid gland. In cases 1 and 2 were benign cystic tumors which did not recur after removal. In cases 3, 4, 5 and 6 were growths reported as mixed tumors, and the patients have been free from recurrence for eight, six, six and five years respectively. These tumors had not been operated on previously.

An extensive scirrhous adenocarcinoma was present in a 67 year old man (case 7). This tumor was explored and, since the base of the skull appeared to be involved, considered inoperable. Palliative irradiation was given without benefit.

Fig. 9.—*A*, malignant melanoma. B, appearance after wide excision and immediate transfer of pedicled flap from lower lip.

A tumor reported as squamous and myxadenocarcinoma was present in a 31 year old woman (case 8). Surgical removal was followed by irradiation. Three years later there was no evidence of recurrence.

In case 9, a mixed tumor that had recurred was removed from a 31 year old woman. Five years later there was no evidence of recurrence. In case 10, a mixed tumor that had recurred was removed by thorough electrocoagulation. Four months later there was no evidence of recurrence. The facial nerve was not injured.

An attempt has been made to condense and embrace the factors involved in the diagnosis and treatment of tumors of the face. Inflammatory, cystic, benign and malignant tumors are included. My personal experience with 339 cases is discussed.

It is felt that all methods of treatment should be considered and the method or combination of methods used that is most suitable for the particular characteristics of each case.

STREPTOMYCIN IN TREATMENT OF SCLEROMA

Report of Three Cases with Successful Results

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ZAGREB, YUGOSLAVIA

EVERY specialist is aware of the resistance of scleroma to any form of therapy. Many methods of treatment—from use of various vaccines to surgical, roentgen and radium therapy—have been tried. In cases with laryngeal and tracheal scleroma lesions, attempts were made to remove new-formed tissue by diathermic coagulation through a tracheostomy opening. However, none of these methods could ever produce a definite cure. It is characteristic of the disease that it recurs at extremely irregular intervals, and symptoms may appear after a long interval, either at the previous site after treatment or in some other part of the respiratory tract. As a rule, the therapies so far applied have succeeded only in restricting the evolutive activity of the disease and thus mitigating its symptoms.

Since scleroma is endemic in Yugoslavia, its incidence is fairly high. There are families with two or three members who have the disease, and probably there is not an otologist who has not observed a case of the disease or attempted to treat it in some way or another.

In the course of the last two years there have appeared in the literature several reports on the use of streptomycin in treatment of scleroma, and on the basis of these reports trials were made at the State Hospital, Zagreb. Results were successful. Therefore, it seemed to bring our experience to the notice of colleagues in countries with a high incidence of scleroma.

Before streptomycin was obtained, my colleagues and I had attempted to treat scleroma with penicillin and sulfonamides, in addition to the established surgical therapy. The results were far inferior to those subsequently obtained with streptomycin regarding both the effect of the treatment and its promptness. Unfortunately, only very small quantities of streptomycin were available, and we were therefore not able to use it in all cases in which we should have liked to try it. The cases which I am reporting are, to my knowledge, the only cases of scleroma treated with streptomycin in Yugoslavia; and I could find only 3 reports in the literature of its use abroad. New, Weed, Nichols

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and Devine,[1] of Mayo Clinic, Rochester, Minn., used a large amount of the antibiotic (95 Gm.) and obtained very good results. Simonetta[2] reported 1 case, and Miller,[3] of Los Angeles, reported 3 cases.

REPORT OF CASES

Case 1.—The patient was a woman, aged 19, who was born at Gareśnica (Croatia, Yugoslavia). The family history is noncontributory. In childhood she had had measles and pertussis, but she had otherwise been healthy until she entered the hospital, on July 13, 1948; at that time she became hoarse, and the hoarseness increased from month to month. In May she noticed difficulties in breathing.

On admission the patient's general health was fairly good. Anterior rhinoscopic examination revealed a rough, reddish, fleshy infiltration at the base of the nose. At some places on its surface small ulcerations were visible; these were of a hard elastic consistency. On touch, the infiltrations bled slightly.

On the border of the soft palate there was a scar, and there was a similar but concentric scar on the posterior wall of the pharynx. The thyroid cartilage appeared deformed and ached on touch; the epiglottis was transversely contracted, scarred and scarcely movable. On the anterior laryngeal commissure there was a flat yellowish gray infiltration.

The ventricular ligaments were infiltrated and of a reddish color resembling that of smoked meat. Since the patient was breathing with difficulty, tracheotomy was done on July 16. Two days later the tracheal mucosa was examined by percervical tracheoscopy. The mucosa was diffusely red and was partly covered by crusts and partly by fresh red infiltrations. A specimen for biopsy was taken from these fresh infiltrations, and scleroma was thus histologically identified.

On July 17, combined treatment with sulfonamides, penicillin and streptomycin was started. On August 18, diathermycoagulation of infiltrations at the base of the nose was done. On September 20, a decannulation was unsuccessfully attempted; it succeeded only on the next attempt, on October 4.

On October 15, the situation in the trachea greatly improved. A fresh infiltration seemed to have been resorbed, and the scars on the soft palate and the back wall of the pharynx had become much softer. The patient breathed freely without a cannula and felt comfortable. She was discharged on October 20.

The patient received altogether 4,500,000 units of penicillin, 42 Gm. of sulfonamides and 35 Gm. of streptomycin.

After six months she returned for reexamination and was found clinically healthy.

Case 2.—The patient was a young man 22 years old, born at Virje (Croatia, Yugoslavia). His father and sister also were suffering from scleroma. He had had measles in childhood but did not remember having other diseases. The patient had been hoarse for the last two years but had no respiratory difficulty. Complications arose only six months before he entered the hospital, in his opinion owing to a cold. He came to the hospital on May 29, 1949 because of dyspnea.

1. New, G. B.; Weed, L. A.; Nichols, D. R., and Devine, K. D.: Rhinoscleroma Apparently Cured with Streptomycin, Ann. Otol., Rhin. & Laryng. **57**:412 (June) 1948.

2. Simonetta: La streptomycine dans la thérapeutique du sclérome, Ann. d'otolaryng. **66**:396 (July-Aug.) 1949.

3. Miller, A. H.: Scleroma of the Larynx, Trachea and Bronchi, Laryngoscope **59**:506 (May) 1949.

There was a circular cicatrix in the soft palate, adhering to the wall of the pharynx. At the base of the nose there was a reddish infiltration reaching up to the left choana.

The olfactory pyramid was externally slightly thickened, as were the alar cartilages, especially the left ones; these were rigid and ached on touch. The vocal ligaments were thickened and infiltrated and had irregular borders. There was a yellowish red infiltration on the left side of the ventricular ligament. Peroral tracheoscopic examination revealed a fresh red infiltration in the trachea, the size of a lentil, hanging from the anterior wall; there were a few infiltrations also on the posterior wall of the trachea. Fresh infiltrations were about 1.5 cm. deep in the left main bronchus and about 0.5 cm. deep in the right. Hard scar tissue was noted at the orifice of the trachea at the level of the second and third tracheal rings. A specimen taken for biopsy from this material revealed the presence of scleroma.

Combined treatment with penicillin, sulfonamides and streptomycin was applied. The patient was given 300,000 units of penicillin a day, 5 Gm. of sulfonamides and 1.5 Gm. of streptomycin. In this case streptomycin was applied also locally, both in the trachea and in the main bronchi.

Five-tenths gram of streptomycin was applied locally every second day by injection through the tracheotomy cannula by means of a long tube on the spraying apparatus. In this way we were able to reach under the control of the eye the infiltrations in the trachea and in the main bronchi. Up to June 14, the patient received 20 Gm. of streptomycin, 3,500,000 units of penicillin and 40 Gm. of sulfonamides. Subsequent bronchoscopic examination revealed no new infiltrations in the bronchi, and the nodular infiltrations from the anterior tracheal wall disappeared as well. Only on the posterior tracheal wall there remained a few minor infiltrations. The vocal ligaments were not so thickened as they were before; the irregular borders disappeared, and the yellowish red infiltration at the left side of the ventricular ligament diminished considerably.

Up to July 11 the patient had received altogether 45 Gm. of streptomycin, 4,500,000 units of penicillin and 55 Gm. of sulfonamides. Tracheoscopic examination revealed no more infiltrations. The tracheal tube which formerly was taken out covered with blood (because of the bleeding from fresh infiltrations) was completely clean; there was no bleeding from the trachea, and the openings of the main bronchi were completely free.

Infiltrations from the ligaments disappeared, and the hard scars in the mesopharynx softened considerably. The sensibility of the olfactory pyramids and of the alar cartilages disappeared.

The patient could breathe normally again; his hoarseness diminished, and he was discharged from the hospital on July 11. No surgical therapy was needed in this case.

The patient came back to be reexamined at the end of October 1949, and his condition was found to be clinically satisfactory.

Case 3.—The patient was a 21 year old woman from Cerovac (Croatia, Yugoslavia). The family anamnesis is irrelevant to the case. She had had measles in childhood. For four months she had been hoarse, and shortly afterward noticed increasing dyspnea. Crusts in the nose also disturbed her breathing. She entered the hospital on Aug. 30, 1948.

The mucosa in the nasal cavity was yellow, atrophic and covered with yellowish green crusts. A red edema was noted in the larynx, subglottically; there were small scales on the left vocal ligament, which fluttered during respiration while the ligaments themselves were red and infiltrated.

During tracheoscopic examination a tube 10 mm. in diameter passed the glottis only with difficulty, as both true cords were infiltrated; they were grayish red, especially on the anterior commissure. The greatest infiltration was in the front, 1 cm. beneath the glottis. Because of dyspnea, tracheotomy was carried out as well.

A specimen for a biopsy was taken from an infiltration in the trachea, and the histologic observations revealed scleroma.

After the patient was given 35 Gm. of streptomycin, 3,500,000 units of penicillin and 38 Gm. of sulfonamides, the decannulation succeeded and the infiltrations from the trachea subsided. Crusts disappeared from the nasal cavity.

The patient was discharged on Jan. 5, 1949 in a greatly improved condition. She came back for reexamination in October 1949. Tracheoscopic examination revealed no infiltrations either in the trachea or in the main bronchi. Her nose was clean, without infiltrations or crusts. She was clinically healthy.

COMMENT AND SUMMARY

When judging the therapeutic effect, one should pay great attention to the clinical findings, because, in my opinion, the question of the etiology of scleroma is still not definitely cleared.

Scleroma being endemic and widely spread in Yugoslavia, it is only natural that it has caused much trouble. Streptomycin proved highly successful in the control of scleroma infiltrations, though our experience was very limited because of the scarcity of the drug, and we were not able to use it in greater quantities and in more cases.

Our purpose is to draw the attention of our colleagues in countries with a high incidence of scleroma to the possibilities streptomycin offers, so that eventually a standard therapy for this serious chronic disease, which so far has seemed incurable, may be developed.

Trg. Marsala Tita 1/11.

FRACTURES OF THE FACIAL BONES

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FOR THE purpose of description, fractures of the facial bones may be divided into four groups: (1) fractures of the nasal bones (recent and old); (2) fractures of the malar bone and superior maxilla (recent and old); (3) fractures of the mandible, and (4) fractures of all the facial bones.

To include all these classifications in this monograph would extend it much too far. The paper will therefore be limited to injuries of the nose and malar-zygomatic arch, since they are of particular interest to the rhinologist and, because of their prominence in the face, are the bones most frequently injured.

The rhinologist, being completely familiar with the anatomy, the physiologic functions and the diagnosis and treatment of disease or injury of the nose and sinuses, should be responsible for the care and repair of these injuries, either immediate or deferred. The structures of the nasal cavity, the septum, the turbinate bodies or sinuses are always involved in injuries of the external nose. The nature and extent of this involvement depend on the type and severity of the injury. Whether the injury is recent or old, both the internal and the external deformities can and should be corrected at the same time so that the patient will obtain normal or near normal nasal function as well as a good cosmetic result. It requires very little additional time to correct completely both internal and external deformities. There is no increase in danger, in hospitalization or convalescing time thereby, and complete correction will avoid all of the inconveniences associated with two separate operations, hospitalizations and loss of time from school or business. Brown[1] made the following statement: "The rhinologist of tomorrow will find himself in a position in which he must practice reconstructive surgery of the nasal pyramid as well as of the internal nose and sinuses in order to restore normal nasal function to his patients."

The most frequent causes of these fractures are injuries resulting from fights, falls, attempted holdups, athletic activities and highway

Candidate's thesis presented in partial fulfilment of the requirements for membership in the American Laryngological, Rhinological and Otological Society, Inc.

1. Brown, J. M.: The Future of Otolaryngology, J. A. M. A. **135**:471 (Oct. 25) 1947.

and airway accidents. With the airplane, the automobile and the motorcycle as means of high speed transportation must be included the motorized bicycle and motor scooter as additional machines of destruction and deformity. Because of the terrific speed attained in these machines, the injuries sustained are usually quite extensive and mutilating, the victims often requiring hospitalization and constituting, accordingly, a large proportion of patients coming under the rhinologist's observation for immediate treatment and repair.

Other instances in which the patients are seen early are those in which the police are involved, such as fights and attempted holdups. Falls and athletic activities also result in severe injuries. Injuries of less severity, injuries occurring in localities where a physician or hospital may not be readily available or injuries resulting from dishonest or dishonorable activities may not be seen early for immediate repair but may be seen later for plastic repair of the deformity. Either the appearance of the person or the degree of nasal obstruction, or both, may be the reason for his seeking medical advice and relief.

Those who served on draft or induction boards during World War II will remember the great number of deformed noses and the smaller number of depressed malar prominences and other facial deformities which were seen almost daily. A great many of these patients may never have sought medical advice because the injury was considered of minor importance. Undoubtedly, many injuries were given no consideration, especially if the deformity was not too unsightly or troublesome; some persons may have been poorly advised and some may have neglected the injury or postponed repair for financial reasons.

The number of persons who became psychologic wrecks or who committed suicide as a result of the unsightly deformities will never be known. Many thus affected physically have become inmates of mental institutions or prisoners in their own homes, some of the latter venturing out only at night when they are less likely to be seen or noticed. The information gathered from these patients or their relatives at times is humorous, at times pathetic; but in all it is serious, and the importance of the early correction of such deformities cannot be emphasized too strongly. The social, psychologic and economic life of many such persons may depend entirely on an early correction of their deformity. Because appearance plays such a tremendous part in many occupations, the economic aspect assumes gigantic proportions. If the person's vocation is one that brings him before the public, an unsightly facial deformity may cause disqualification no matter how talented he may be. It is very unusual for one to be able to capitalize on a facial deformity; capitulation is much more likely. The change in character, in disposition and in mental attitude after a satisfactory correction must be seen to be appreciated; it canot be properly or adequately described.

The age of the patient should not be a factor in timing the necessary corrective surgery. As soon as a child is old enough to realize he has a facial deformity and starts to comment on it, correction should be made promptly if psychologic damage is to be avoided. If the accident occurred early in life, attention to the deformity is usually attracted on or shortly after the child enters school or about puberty. Either the unsightly appearance of the one afflicted or the unkind remarks of others will be a compelling influence in urging correction.

If such patients are seen immediately after injury their repair is comparatively simple and easy; and repair should be done as soon as the patient's condition permits. The difficulty of complete and satisfactory reduction of these fractures undoubtedly increases with the passing of time. Many authorities—Straith,[2] Blair and Byars,[3] Osborn,[4] Brown [5]—advocate early repair, provided that there are no complications which would contraindicate the necessary surgical interference.

The preliminary examination should be extremely thorough and complete, so that injuries to other parts of the body, attention to which may be of greater importance, will not be overlooked. If there are severe lacerations of the face, the wound should be thoroughly cleansed and the edges brought into perfect approximation immediately; reduction of fractured facial bones can be safely postponed a few days or until the patient's general condition permits further interference.

Of the utmost importance in the management of recent injuries is the control of hemorrhage; treatment of shock; administration of supportive measures by intravenous feedings and transfusions of blood when necessary; the use of penicillin and sulfonamide drugs for the prevention or control of infection; the administration of tetanus or bivalent gas gangrene antitoxin U. S. P. when indicated; the control of pain, and any other measures necessary for the welfare of the patient.

RECENT FRACTURES OF THE NASAL BONES

Recent injuries to the nasal bones may affect three places, the dorsum, the lateral wall, the tip, depending on the force and direction of the blow and the size, shape, surface and nature of the object inflicting the injury. The bony bridge alone or both the bony and the cartilaginous bridges may be crushed flat, displaced laterally or upward, or any

2. Straith, C. L.: Management of Facial Injuries Caused by Motor Accidents, J. A. M. A. **108**:101 (Jan. 9) 1937.

3. Blair, V. P., and Byars, L. T.: The Desirability of Early Proper Treatment of Face Injuries, Texas State J. Med. **38**:533 (Jan.) 1943.

4. Osborn, C. H.: The Management of Facial Injuries, M. J. Australia **2**:41 (July 9) 1938.

5. Brown, J. B.: Fractures of the Bones of the Face, Surg., Gynec. & Obst. **68**:564 (Feb., no. 2 A) 1939.

combination of all three may occur. If there are no complications reduction should be done as soon as practicable after injury. Almost all these injuries are compounded internally; the severer ones may be compounded externally. They may also be impacted, comminuted and complicated by involvement of the sinuses, the orbit or the cribriform plate of the ethmoid bone. If the lamina papyracea or the internal and anterior walls of the maxillary sinus are fractured, emphysema of the orbital tissues or the cheek will be evident on blowing the nose. Cerebrospinal rhinorrhea indicates fracture through the cribriform plate, and attempts at reduction should be postponed until the rhinorrhea subsides or stops; during this time adequate amounts of penicillin and the sulfonamides should be administered. If the necessary delay is more than a week or ten days, great difficulty in reduction may be encountered. In rare instances it may be advisable to forego immediate repair and do the necessary plastic repair at a later date.

A. Injuries to the Dorsum.—Such injuries are the result of falls and accidents with bicycles, in motorized transportation and in certain athletic activities—football, baseball, basket-ball, hockey and lacrosse. If the force of the blow is directed perpendicularly by a large, flat, heavy mass, the entire bony and cartilaginous bridge will be flattened against the face, leaving a flat, wide nose. If only the bony or the cartilaginous bridge is injured their normal arch will be destroyed or altered, resulting in a saddle nose.

B. Injuries to the Lateral Wall.—Such injuries are the result of accidents in which the force of the blow is directed laterally against one side of the nose. One or both nasal bones may be broken and displaced laterally, depending on the force and nature of the object inflicting the injury. In the milder injuries only one of the nasal bones may be fractured and depressed, giving a sunken, or concave, appearance to one side of the nose. If both bones are broken the entire nose will be deflected to one side.

C. Injuries to the Tip.—Such injuries are usually the result of a fall against a projecting or elevated surface, such as a curb, ladder rung and table or chair edge, or from athletic activities, such as lacrosse or hockey. The anterior nasal spine is usually fractured and displaced, either backward and upward or laterally with corresponding deformity of the columella and septum.

ANESTHESIA

If the injury has been more or less mild with little or no impaction of the bony fragments, correction can be done with local anesthesia, with 5 to 10 per cent cocaine solution applied locally over the nasal mucosa, and the injection of 0.5 per cent procaine hydrochloride U. S. P. (novocain®) submucously and subcutaneously. If there is marked impaction

of the fragments, a great deal of force may be necessary to break up the impaction and local anesthesia will not control the pain sufficiently for satisfactory reduction. General anesthesia with thiopental sodium (pentothal sodium®) or nitrous oxide, oxygen and ether will be necessary and advisable. In children, the use of general anethesia is safer and better.

Fig. 1.—*A*, Asch forceps. *B*, forceps in position, one blade inside the nose and one blade outside. *C*, bone gouge.

TREATMENT

A nasopharyngeal pack should first be inserted to prevent blood from escaping into the throat. The blades of an Asch forceps (fig. 1, *A*) are introduced into the nose, one on each side of the septum, and force is

directed upward against the bridge to lift the bones into position. If there has been any fractures or dislocation of the nasal septum from its groove in the vomer, this manipulation will largely or entirely correct that. If there has been lateral displacement of the nasal bones, with impaction, one blade of the Asch forceps can be placed externally and one internally (fig. 1, *B*) and the displaced fragments manipulated into position by rocking and lifting. Sometimes the blade of a long, strong nasal speculum can be used to force displaced fragments outward and upward. This instrument is especially useful in cases in which only one of the nasal bones has been fractured with downward and inward displacement. Another very satisfactory instrument, especially in a narrow nose, is a heavy bone gouge with a slender shaft (fig. 1, *C*). If these instruments are used carefully and gently it will not be necessary to cover them with rubber tubing to protect the nasal mucosa.

Fig. 2.—Recent fractures of one nasal bone. *A*, before repair. *B*, after repair. *C*, adhesive and sheet lead splint.

The tubing increases the size of the instrument, making it more difficult to introduce and manipulate and causing additional and unnecessary trauma. Slight overcorrection is desirable. After reduction has been accomplished, both nostrils are firmly, but not tightly, packed with dibucaine (nupercaine®) gauze. The nose can now be molded perfectly to the desired shape and all irregularities smoothed out by manipulation with the fingers over the external nose (fig. 2, *A* and *B*). This procedure is especially easy in the egg shell type of fracture. Adhesive tape is then placed over the skin of the nasal bridge and cheeks and a splint of thin sheet lead placed over that and held in place by adhesive strips (fig. 2, *C*). The pack is removed in twenty-four hours. The interior of the nose is kept clean by a small suction tip or by gentle irrigations with warm saline solutions. The external splint should be kept in place for about two weeks and changed every few days to keep it clean and to minimize skin irritation.

OLD FRACTURES OF THE NASAL BONES

The deformities resulting from old fractures of the nasal bones may be divided into the following classifications.

1. Flat wide nose
   (*a*) Bony portion
   (*b*) Cartilaginous portion
   (*c*) Bony and cartilaginous portions
2. Saddle nose
   (*a*) Bony bridge
   (*b*) Cartilaginous bridge

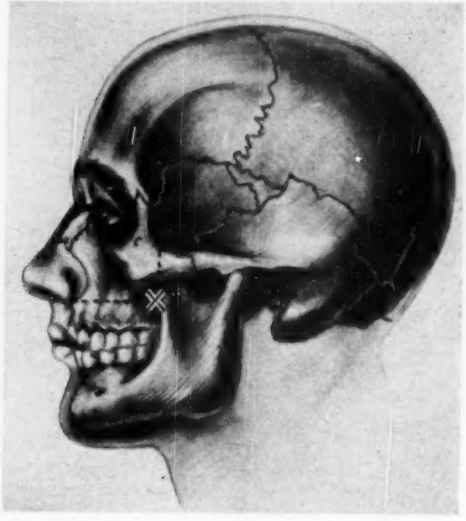

Fig. 3.—× indicates the site of injection into the sphenopalatine ganglion.

3. Crooked nose
   (*a*) Bony deviation
   (*b*) Cartilaginous deviation
   (*c*) Bony and cartilaginous deviation
4. Humped nose
5. Deformities of tip and columella
6. Any combination of two or more of the preceding classifications.

The detailed technic of the preparation of the operative field, the type and location of incisions, sutures and suture material, the extent of skin undermining, points of injection for local anesthesia, the instrumentarium and other important information can be found in the standard

textbooks covering rhinoplastic surgery—Sheehan,[6] Safian,[7] Barsky,[8] Fomon,[9] military surgical manuals[10] and others. In young children and highly nervous adults it will be advisable to use general anesthesia. Bleeding can be greatly reduced by the injection of 0.5 per cent procaine hydrochloride solution containing one drop of 1:1000 epinephrine U. S. P. (adrenalin®) per drachm of solution. Postoperative pain and discomfort can be largely controlled by injection of this solution into the sphenopalatine ganglion through the sphenomaxillary fissure, which is easily located on the surface at the junction of two imaginary lines, one drawn horizontally backward from the nasal tip, the other vertically downward from the malar-zygomatic junction (fig. 3).

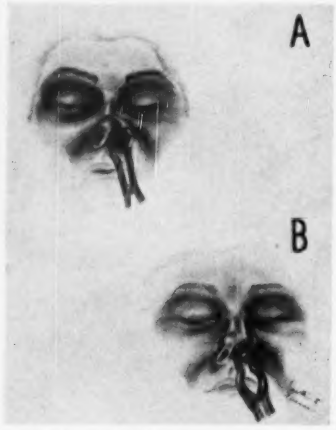

Fig. 4.—*A*, intercartilaginous incision. *B*, one blade of Asch forceps inside the nose and one blade under the skin.

REPAIR OF FLAT WIDE NOSE

A transfixion incision is made through the mobile columella and joined with an intercartilaginous incision in each nostril (fig. 4). The skin over the entire nasal dorsum is undermined. An incision is made

6. Sheehan, J. E.: Plastic Surgery of the Nose, ed. 2, New York, Paul B. Hoeber, Inc., 1936.

7. Safian, J.: Corrective Rhinoplastic Surgery, New York, Paul B. Hoeber, Inc., 1935.

8. Barsky, A. J.: Plastic Surgery, Philadelphia, W. B. Saunders Company, 1938.

9. Fomon, S.: The Surgery of Injury and Plastic Repair, Baltimore, Williams & Wilkins Company, 1939.

10. Manual of Standard Practice of Plastic and Maxillofacial Surgery, National Research Council, Division of Medical Sciences (Military Surgical Manual, no. 1), Philadelphia, W. B. Saunders Company, 1942.

over the lower edge of the nasal bones in midline and the periosteum is carefully elevated. A saw is inserted under the periosteum directed

Fig. 5.—Wide, flat nose. *A*, before repair. *B*, after repair.

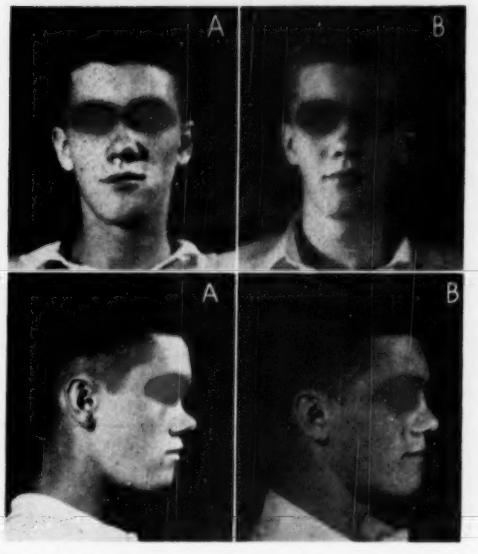

Fig. 6.—Saddle deformity of bony bridge. *A*, before repair. *B*, after repair.

downward, and the nasal bones are sawed through in midline. An incision is now made at the lower border of the piriform aperture, the periosteum elevated and a saw inserted along the lower lateral wall of

the nasal bone and the bone cut through. One blade of the Asch forceps is inserted under the skin, one blade inside the nostril (fig. 4, *B*), and the nasal bone is fractured by twisting and rocking. This procedure assures a clean break at the proper level. It is much more accurate than external pressure with the thumb and much easier and simpler than the use of a hammer and chisel. The same procedure is followed on the other side. Both nasal bones are now free to be moved closer together. This movement will both narrow and raise the nasal bridge (fig. 5). If the bridge has not been raised sufficiently, a cartilage implant, obtained either from the nasal septum or from costal cartilage,

Fig. 7.—Saddle deformity of cartilaginous bridge corrected by septal cartilage implant. *A*, before repair. *B*, after repair.

can be inserted under the skin of the nasal dorsum. The columellar incision is closed with two silk sutures on each side. Both nostrils are then lightly packed with dibucaine gauze, and an external dressing of adhesive and sheet lead is applied. The pack is removed in twenty-four hours, the sutures in five to six days and the external splint in about two weeks.

REPAIR OF SADDLE NOSE (BONY BRIDGE)

An intercartilaginous incision is made in each nostril and the skin over the nasal dorsum undermined. A piece of costal cartilage is removed from the area of the seventh, eighth and ninth ribs, carved into

the proper size and shape to fit the deformity and inserted underneath the skin (fig. 6). Both nostrils are lightly packed with dibucaine gauze, and an external dressing of adhesive and sheet lead is applied. The pack is removed in twenty-four hours and the external dressing in about two weeks.

REPAIR OF SADDLE NOSE (CARTILAGINOUS BRIDGE)

Injuries or defects producing the saddle nose vary greatly in size and may be corrected either by costal cartilage or by septal cartilage implant. If a submucous resection has not been previously done and the defect is not too large, enough septal cartilage can be obtained to fill in the saddle deformity (fig. 7). If the defect is quite large, costal cartilage is easily obtained and is used in the same manner as described for saddle deformity of the bony bridge (fig. 8).

Fig. 8.—Saddle deformity of cartilaginous bridge corrected by costal cartilage implant. *A*, before repair. *B*, after repair.

REPAIR OF CROOKED NOSE

A. Bony Deviation.—Incision and procedure here are the same as those followed in repair of a wide, flat nose. After the bones are sawed and broken, they are molded into position (fig. 9, *A* and *B*). Both nostrils are then packed lightly with dibucaine gauze, which is removed in twenty-four hours. The external dressing of adhesive and sheet lead is maintained about two weeks.

B. Cartilaginous Deviation.—Most of these deformities are due to anterior deflection and dislocation of the septal cartilage. Submucous resection of the septum, together with proper trimming of the anterior margin of the septal cartilage, and either shaving or removal of the anterior nasal spine will correct almost all such deformities (fig. 9, *C* and *D*). The incision is closed with two silk sutures and a light pack of dibucaine gauze applied, to be removed in twenty-four hours. Postoperative care is the same as that in a submucous resection of the septum. External splinting is unnecessary.

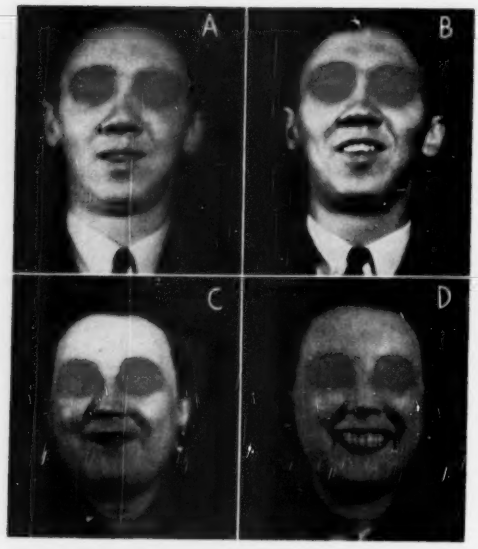

Fig. 9.—Crooked nose, bony portion. *A*, before repair. *B*, after repair. Crooked nose, cartilaginous portion. *C*, before repair. *D*, after repair.

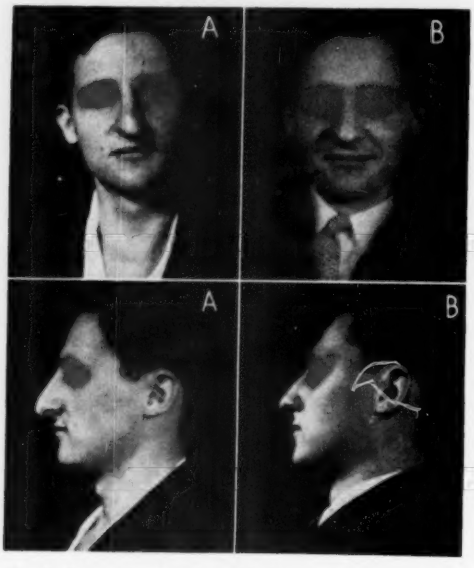

Fig. 10.—Crooked nose, bony and cartilaginous portion. *A*, before repair. *B*, after repair.

C. Bony and Cartilaginous Deviation.—These deformities require a combined operation: a submucous resection of the septum and sawing through the nasal bones, down through the midline of the dorsum and near the nasomaxillary articulation (fig. 10). The columellar incision is closed with two silk sutures on each side. Both nostrils are lightly packed with dibucaine gauze, to be removed in twenty-four hours. An external splint of adhesive and sheet lead is maintained for two weeks. The sutures are removed in five or six days.

Fig. 11.—Humped nose. *A*, before repair. *B*, after repair.

CORRECTION OF HUMPED NOSE

Incisions are made and the skin is undermined in the same manner as that for repair of the wide, flat nose. The periosteum is gently elevated over the hump; the saw is introduced on one side of the hump, and one nasal bone is cut through, with a saw mark left in the bone on the opposite side. The bone on the opposite side is then sawed through at the mark and the hump removed. The saw is next introduced into an incision at the piriform aperture and the lateral saw cut made through the nasal bones on both sides. The bones are fractured with the Asch forceps and manipulated into position (fig. 11). The columellar incision is closed with silk sutures on both sides. Both nostrils are

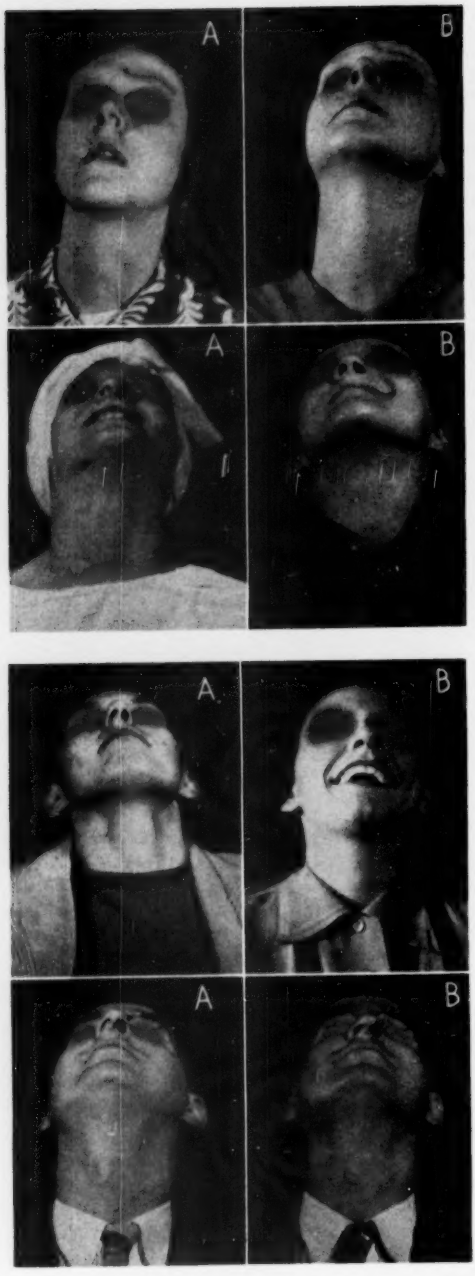

Fig. 12.—Various types of fracture dislocation of the anterior edge of septal cartilage and anterior nasal spine. *A*, before correction. *B*, after correction.

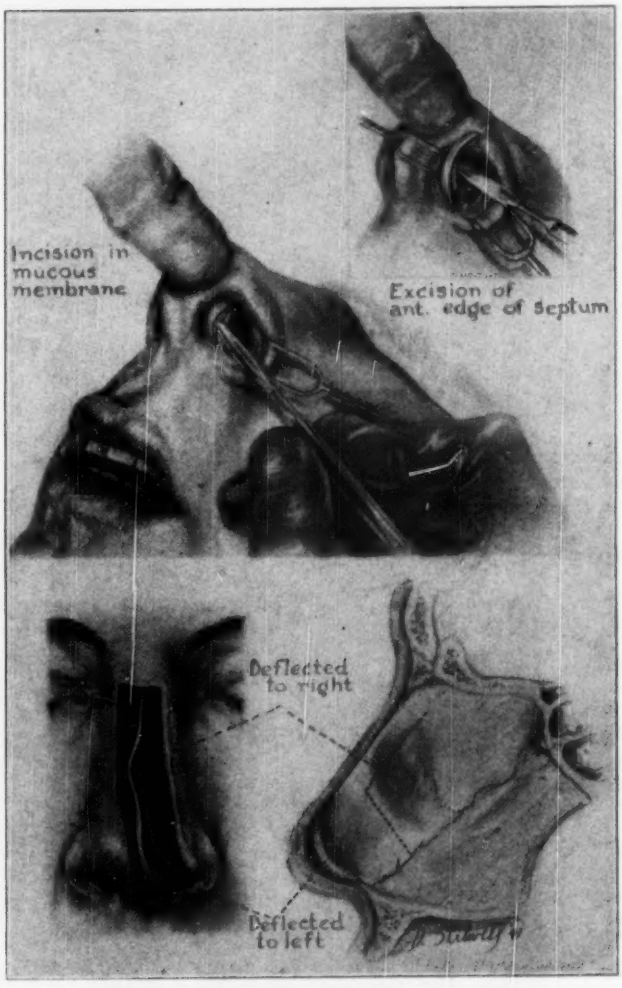

Fig. 13.—Incision for submucous resection of the septum and correction of deformities of the anterior edge of the septal cartilage.

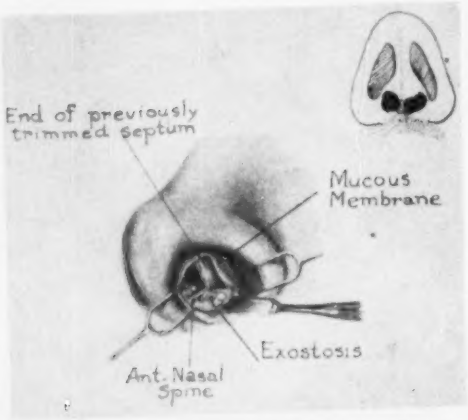

Fig. 14.—Method of removal of part or all of the anterior nasal spine.

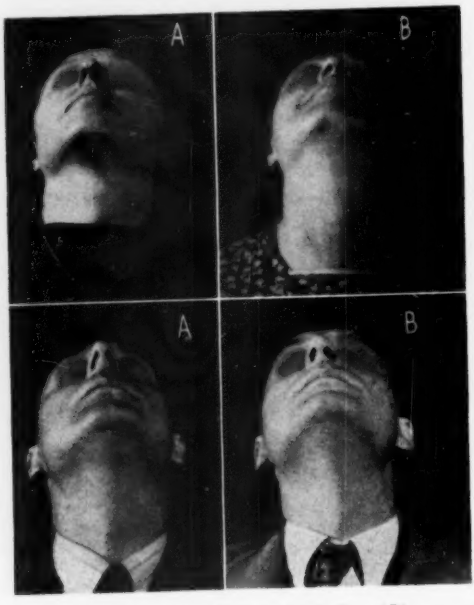

Fig. 15.—Thickened columella before (*A*) and after (*B*) removal of anterior nasal spine.

lightly packed for twenty-four hours; an external dressing of adhesive and sheet lead is maintained for two weeks. The sutures are removed in five or six days.

DEFLECTIONS AND DEFORMITIES OF THE COLUMELLA AND ANTERIOR SEPTAL MARGIN

Deformities of the columella and anterior septal margin are due to fractures of the anterior nasal spine, with displacement upward, upward and backward or laterally, and to fracture dislocation of the anterior edge of the septal cartilage (fig. 12). The ideal approach is through an incision at the anterior margin of the septal cartilage used for submucous resection (fig. 13). If the anterior edge of the septal cartilage is curved or dislocated from its bed in the vomer it can be shaved or the curved edge removed by excision. The anterior spine is exposed and can be shaved by hammer and chisel or completely removed in the same manner (fig. 14). This procedure will allow the septal cartilage and columella to fall back into their normal position. A markedly thickened columella is almost always caused by an unusually wide and thick anterior nasal spine, which when removed will diminish the thickening of the columella and provide better breathing space (fig. 15). In some cases it may be advisable to place a mattress suture through the columella, tied over small lead buttons to eliminate dead space and prevent formation of a hematoma. The incision is closed with two silk sutures, and the nostrils are lightly packed with dibucaine gauze for twenty-four hours. The sutures are removed in five to six days.

FRACTURES OF THE MALAR-ZYGOMATIC ARCH

Injuries to the malar-zygomatic arch generally occur in fights, falls, attempted holdups and in accidents in motorized transportation and athletic activities. Straith [11] classified the results of motorized accidents into two groups—injuries to the driver and injuries to the guest passenger. The symptoms presented will depend on the severity and extent of the injury and the involvement of adjacent structures: the orbit, sinuses and mandible. Surgical shock of some degree is almost always present. Hemorrhage may or may not be extensive. There may be only an extensive ecchymosis extending outward from the site of injury.

If the orbital wall is fractured there may be extensive hemorrhage into the orbital tissue, causing interference with the mobility of the eyeball, or if the floor of the orbit is involved displacement downward

11. Straith, C. L.: Guest Passenger Injuries, J. A. M. A. **137**:348 (May 22) 1948.

will result in double vision. Hemorrhage into the ethmoid and maxillary sinuses may cause pain and swelling, and if adequate drainage is not established within a reasonable time infection will supervene. Emphysema may be present if the nose and sinuses are involved.

Deformity will depend on the type and severity of the injury. In the milder cases there may be only a slight depression of the malar-zygomatic arch. In the severer cases the skin and superficial tissues may be lacerated and the malar-zygomatic arch crushed inward and downward, with an egg shell fracture of the walls of the maxillary sinus. Not infrequently, the fragments of the zygoma are displaced downward against the condyle of the mandible, causing restriction or immobility of the movements of the joint, resulting in extreme difficulty or severe pain in mastication.

Diagnosis can best be made by inspection and palpation of the involved bones, comparisons being made with the uninvolved side. Roentgenologic studies should be made, at least for legal purposes, but many times they do not reveal the nature or extent of the injuries, probably because of the confusion produced by overlapping bone shadows.

TREATMENT

Some authors advise postponing reduction until swelling subsides, waiting as long as two weeks or more. Most authorities (Shea,[12] Woodward and Fitz-Hugh,[13] Straith [14] and others) favor reduction as early as possible. I believe that difficulty in reduction increases with every passing day and that operation should be done as soon as the condition of the patient permits the necessary surgical procedure. Numerous methods of reduction have been described by Gill,[15] Roberts,[16] Matas,[17]

12. Shea, J. J.: The Management of Fractures Involving the Paranasal Sinuses, J. A. M. A. **120**:745 (Nov. 7) 1942; The Management of Fractures of Facial Bones, Mississippi Doctor **18**:498 (Feb.) 1941.

13. Woodward, F. O., and Fitz-Hugh, G. S.: The Management of Recent Facio-Maxillary and Mandibular Fractures, Virginia M. Monthly **69**:612 (Nov.) 1942.

14. Straith, C. L.: The Treatment of Facial Wounds Due to Motor Accidents, J. Michigan M. Soc. **36**:64 (Feb.) 1935.

15. Gill, W. D.: Fractures About the Orbit, South. M. J. **21**:527 (July) 1928; Fractures Involving the Orbit and Paranasal Sinuses with Special Reference to Diagnosis and Treatment, Texas State J. Med. **27**:351 (Sept.) 1931.

16. Roberts, S. E.: Fractures of the Malar-Zygomatic Arch, Ann. Otol., Rhin. & Laryng. **37**:826 (Sept.) 1928.

17. Matas, R.: Fractures of the Zygomatic Arch, New Orleans M. & S. J. **49**:139 (Sept.) 1896.

Keen,[18] Ivy and Curtis,[19] Gillies [20] and Lothrop.[21] Lothrop's approach is preferable because all the bones involved in the injury—the floor of the orbit, the malar-zygomatic arch and the walls of the superior maxilla—can be easily seen and by appropriate manipulation can be returned to normal or near normal position and held in place by means of gauze packing placed in the antrum. The blood clot, secretions and bone fragments can be removed from the antrum and adequate intranasal drainage established without the disadvantage of an external incision and possible additional scarring.

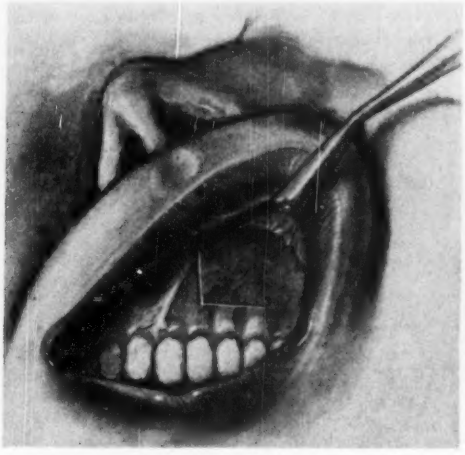

Fig. 16.—Right angle incision over canine fossa.

OPERATION

A right angle incision (fig. 16) is made over the canine fossa on the involved side and the mucoperiosteum carefully retracted. This procedure exposes the anterior wall of the antrum and the various fracture lines. The fragments of bone are easily seen and may be removed or retracted out of the field to insure proper inspection.

18. Keen, W. W.: Surgery: Its Principles and Practice, Philadelphia, W. B. Saunders Company, 1916, vol. 6, p. 66.

19. Ivy, R. H., and Curtis, L.: Fractures of the Jaws, ed. 2, Philadelphia, W. B. Saunders Company, 1938.

20. Gillies, H. D.; Kilner, T. P., and Stone, D.: Fractures of the Malar-Zygomatic Compound, Brit. J. Surg. **14**:651 (April) 1927.

21. Lothrop, H. A.: Fractures of the Superior Maxillary Bone Caused by Direct Blows Over the Malar Bone: A Method Used for the Treatment of Such Fractures, Boston M. & S. J. **154**:8 (Jan.) 1906.

All these fragments, or as many as possible, should be carefully preserved, and their periosteal attachments should not be injured or destroyed. An opening just large enough to permit proper visualization and manipulation is made through the anterior wall. Blood clot, secretion and bone fragments are removed by suction and forceps. A piece of plain 1 inch (2.5 cm.) strip gauze is introduced, which will about half fill the antral cavity. A heavy Kelly clamp is inserted against this gauze cushion, and sufficient pressure in a direction upward or upward and outward is exerted to reduce completely or to overcorrect slightly the fractured bones. The strip gauze cushion should be removed, as some parts of it may be caught between bone fragments and cause difficult and painful removal forty-eight hours later. An opening of sufficient size to provide adequate drainage and assure easy postoperative treatment is made through the nasoantral wall. The importance of antral drainage is stressed by almost all authorities, to prevent infection and possible osteomyelitis of the bony wall. Adequate doses of penicillin and sulfonamides should be started immediately after operation to minimize or to prevent these complications. If osteomyelitis should occur there is great possibility of localized areas of infection appearing under the skin of the face with rupture onto the surface, causing additional scarring with deformity. The antrum is firmly packed with dibucaine gauze and the end withdrawn into the nose. The incision is closed with two or three black silk or cotton sutures.

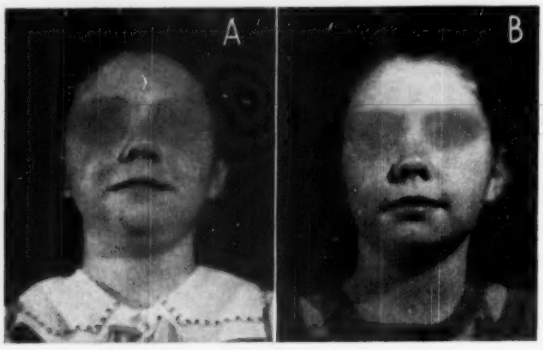

Fig. 17.—Fracture of right malar-zygomatic arch. *A*, before repair. *B*, after repair.

The malar-zygomatic arch is now inspected and palpated, comparisons being made with the uninvolved side to make certain that the deformity has been properly and completely corrected. If there has been overcorrection, it is easily adjusted by proper pressure of the thumb and fingers against the bones involved (fig. 17). The pack is

removed in forty-eight hours. The sutures are removed in six or seven days. The nose and sinuses are kept clean by gentle irrigation with warm saline solution or suction. Healing is usually complete in three or four weeks.

SUMMARY

Treatment of fractures of the nose and malar-zygomatic arch either recent or old should be the responsibility of the rhinologist.

Recent injuries should be treated as soon as practicable. Old fractures should be corrected as soon as the patient becomes aware of a deformity.

Deformities of the internal and external nose should be corrected as successive steps in a single operative procedure.

Choice of anesthesia depends on the type and severity of the injury, the age and mental attitude of the patient and the judgment of the surgeon.

Results will be uniformly good if all the details of good surgical technic and practice are observed.

Medical Arts Building, 101 West Read Street.

PRIMARY LYMPHANGIOENDOTHELIOMA OF THE NOSE

WEN-CHIH HUNG, M.D.
TAIPEH, FORMOSA

THE ENDOTHELIOMA has been one of the debatable tumors in pathology. Histologically, it is composed mainly of anastomosing cords and nests of epithelial cells with central lumens in a bed of connective tissue stroma, and is characterized clinically by slow-growing, local progression, absence of metastases, prompt regression on irradiation and recurrences after excision.

In the otolaryngologic field, such a lesion involving primarily the nose is comparatively rare, but it occurs commonly in the palate.

The present report of a case of nasal tumor is worthy of record because of its characteristic histologic changes and interesting origin.

REPORT OF A CASE

C. W., a man aged 59, was seen on July 19, 1949, with the complaint of nasal obstruction on the right side. He first became aware of the difficulty in nasal respiration about three months prior to his visit. He had never had disturbances of vision or headaches. The personal and family history was noncontributory. Examination of the left side of the nose indicated nothing abnormal, but the right cavity was filled with a greenish, grayish white mass, which did not bleed easily on being touched with a probe. A small amount of mucopurulent secretion surrounded the mass. In the nasopharyngeal space no tumor mass was evident. Roentgenograms disclosed a mass involving the right nasal cavity; the right antrum was cloudy, and the ethmoid cells were slightly hazy. The contour of the right inferior turbinate bone had disappeared, but the other bony structures were free from change. There were no palpable glands in the neck. The results of the other physical examinations were essentially within normal limits. The Wassermann reaction was negative, and studies of the blood showed no anemia.

With the patient under local anesthesia, Denker's operation was performed, succeeding a preliminary ligation of the right external carotid artery. There were no tumorous involvement in either the antrum or the ethmoid cells, but there was scanty mucous secretion in the antral cavity, the mucous membrane of which showed edematous swelling. Finally, the growth could easily be removed as a whole without any adhesion to the septum or the turbinate bodies.

The patient recovered rapidly from the operation. He was, moreover, treated with 1,000 r of high voltage radiation in divided doses to avoid the recurrences and returned home one month after the operation. He has remained entirely free from symptoms.

The growth was approximately cubiform, somewhat like a trepang, and attached to the mucous membrane of the right middle meatus with a bandlike pedicle. Its

From the Department of Otolaryngology, Faculty of Medicine, National Taiwan University (Prof. Dr. Tien-su Lin, Director).

Fig. 1.—Roentgenogram showing cloudiness at the right side of the nose and the paranasal sinuses.

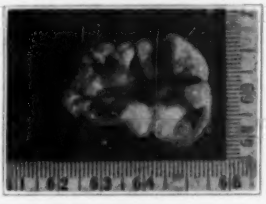

Fig. 2.—Gross specimen.

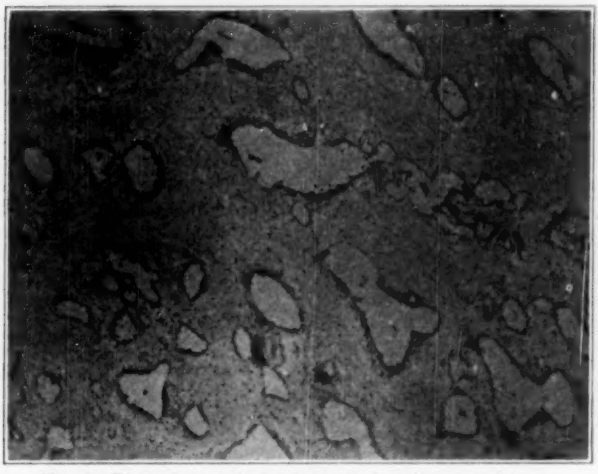

Fig. 3.—Photomicrograph showing typical angiomatous picture.

surface was partially dark reddish and partially greenish, grayish white and was covered by a scanty necrotic mass with a roughened appearance. It weighed 5.9 Gm. and measured about 3.5 by 2.5 by 1.0 cm. It was elastic yet firm in consistency. On cross section it was grayish white but not bloody.

The histologic examination revealed a tumor composed of endothelial cells forming spongelike meshwork or anastomosing cords embedded in scanty fibrous stroma. The cells were polyhedral or spindle shaped with clear cytoplasm and, in general, vaguely delimited. Their nuclei were ovoid or roundish with moderate chromatin. Mitotic figures were infrequent. Those cells which lined the capillary spaces were the fully differentiated littoral cells. In the central lumens there were no blood cells, but a few lymphocytes were occasionally scattered about. Necrotic changes occurred in some areas where marked leukocytic infiltration and congestion were seen. In places, the surface of the tumor was lined with stratified or columnar epithelium. Microscopically, the antral membrane showed nothing more specific than edematous changes. The small lymph node removed at the time of the ligation of the right external carotid artery presented normal architecture. Thus, the growth was considered to be a primary lymphangioendothelioma arising from the right middle meatus and had no relation with the paranasal sinuses.

REVIEW OF THE LITERATURE

Reports on endothelioma of the nose and accessory sinuses have been given in the literature, but reports on primary lymphangioendothelioma of the nose are quite rare. Miyoshi [1] found 104 cases of endotheliomas in the literature on the otolaryngologic field reported from 1917 to 1936 in Japan. In his article, 26 cases (25.0 per cent) were of the nose and paranasal cavities, but more than half (55 cases, 52.88 per cent) had arisen from the palate. There were only 4 endotheliomas among 41 malignant tumors of the nose and accessory sinuses from 20,542 patients during ten years (1927-1936) in his clinic. Of 7,097 patients with diseases of the nose and paranasal sinuses, Tanaka [2] reported only 2 endotheliomas among 34 malignant growths. In a series of 579 neoplasms of the nose and accessory sinuses, Beck and Guttman [3] observed only 5 endotheliomas and 2 cylindromas.

As compared with other malignant growths of the nose and paranasal sinuses, the rare incidence of endothelioma is demonstrated in the table, in which the authors' number of cases is listed.[4]

1. Miyoshi, Y.: Statistische Zusammenstellung aller in der japanischen Literature befindenen Fällen von Endotheliom auf dem Gebiete der Oto-Rhino-Laryngologie, Ztschr. f. Oto-, Rhino- u. Laryng. **44**:1930, 1938; Ueber 2 Fälle von Hämangioendotheliom am Septum der Nase, ibid. **44**:1924, 1938.

2. Tanaka, F.: Pathologische Untersuchungen über die bösartigen Geschwülste der Nase und Nebenhöhlen, Ztschr. f. Oto-, Rhino- u. Laryng. **25**:370, 1918.

3. Beck, J. C., and Guttman, M. R.: Malignant Diseases of the Nose and Nasal Accessory Sinuses, Ann. Otol., Rhin. & Laryng. **41**:1, 1932.

4. (*a*) Finder, G.: Einige Bemerkungen über maligne Nasengeschwülste, Arch. f. Laryng. u. Rhin. **5**:302, 1896. (*b*) Hammer: 22 Tumoren des Oberkiefers und angrenzenden Gegenden, Virchows Arch. f. path. Anat. **142**:503, 1895.

More than 100 reports on cases of endothelioma have already been given: Althoff [5] (1907); Pollak [6] (1911); Knauer [7] (1920); Barmwater [8] (1932); Eigler [9] (1932); Beck and Guttman [10] (1936); Takahashi [11] (1937); Miyoshi [1] (1938); Ohishi [12] (1939); Gon [13] (1940);

(*c*) Maljutin: Bösartige Neubildungen der Nasenhöhle und ihre chirurgische Behandlungen, Internat. Centralbl. f. Laryngol., Rhinol. **190**:317, 1901, cited by Harmer and Glas.[4d] (*d*) Harmer, L., and Glas, E.: Die malignen Tumoren der inneren Nase: Eine klinisch histologische Studie, Deutsche Ztschr. f. Chir. **89**:433, 1907. (*e*) Marschik-Chiari, cited by Denker.[4h] (*f*) Ferreri, G.: Prognose und Therapie der malignen Tumoren der Nase und des Nasenrachenraumes, Monatsschr. f. Ohrenh. **48**:873, 1914. (*g*) Okonogi, S.: Ueber die bösartige Geschwülste der Nase und Nebenhöhlen, Ztschr. f. Oto-, Rhino.- u. Laryng. **25**:364, 1918. (*h*) Denker, A.: Die bösartigen Neubildungen der Nase und ihrer Nebenhöhlen, in Handbuch der Hals-Nasen-Ohrenheilkunde mit Einschluss der Grenzgebiete, Berlin, Julius Springer, 1929, vol. 5, p. 204. (*i*) Tanaka, K.: Ueber maligne Tumoren der obern Luftwege in unserer Klinik: Arbeitssammlung aus der Otorhinolaryngologischen Klinik der kaiserlichen Tohoku Universität zu Sendai, 1935, p. 337. (*j*) Koshino: Klinisch-statistische Untersuchung über die malignöse Geschwülste in otorhinolaryngologischen Gebiete, Jibi Rinsho **31**:1039, 1936. (*k*) Azumi, T., and Kawamura, K.: Statistische Untersuchungen über die in den letzten 12 Jahren in der otorhinolaryngologischen Klinik der medizinischen Fakultät Nagoya beobachteten Geschwülste der oberen Luftwege, Ztschr. f. Oto-, Rhino- u. Laryng. **45**:1051, 1939. (*l*) Rin, T., and Ryu, S.: Klinisch-statistische Untersuchungen über die in Formosa beobachteten bösartigen Geschwülste des Otorhinolaryngologischen Gebietes, besonders über die bösartigen Epipharynxtumoren, Ztschr. f. Oto-, Rhino- u. Laryng. **47**:583, 1941. (*m*) Yeh, S., and Tu, S.: A Histological Study of Nasopharyngeal Carcinoma, J. Formosan M. A. **48**:113, 1949.

5. Althoff, E.: Ueber Endotheliome der inneren Nase und der Nebenhöhlen, Arch. f. Laryng. u. Rhin. **19**:220, 1906-1907.

6. Pollak, E.: Ueber die "endothelialen" Geschwülste der Nase und ihrer Nebenhöhlen, Arch. f. Laryng. u. Rhin. **25**:383, 1911.

7. Knauer, I.: Ueber einen Fall von kapillarem Hämangioendotheliom im mittleren Nasengang mit besonderer Berücksichtigung seiner Genese, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **105**:14, 1920.

8. Barmwater, K.: Endothelioma Cavi Nasi, Internat. Zentralbl. f. Ohrenh. **35**:108, 1932.

9. Eigler, G.: Ueber Endotheliome, Peritheliome, Cylindrome und ähnliche Tumoren der oberen Luftwege, Arch. f. Ohren-, Nasen- u. Kehlhopfh. **132**:209, 1932.

10. Beck, J. C., and Guttman, M. R.: Basaloma or So-Called Cylindroma of the Air Passages, Ann. Otol., Rhin. & Laryng. **45**:618, 1936.

11. Takahashi, T.: Hemangioendothelioma of the Middle Turbinate, Oto-Rhino-Laryng. (Tokyo) **10**:426, 1937.

12. Ohishi, K.: Lymphangioendothelioma of the Nasal Septum, Ztschr. f. Oto-, Rhino- u. Laryng. **45**:751, 1939.

13. Gon, S.: Lymphangioendothelioma of the Nasal Vestibule, Oto-Rhino-Laryng. (Tokyo) **13**:788, 1940.

Higashi and Shiraiwa [14] (1941); Fuzii [15] (1942), and Awataguchi [16] (1949) and others.

A majority of the growths described developed primarily from the paranasal sinuses, especially the maxillary. There were also many cases in which both nasal and paranasal cavities were involved. Only in a few cases the growth obviously occurred primarily in the nasal cavity and was detected in an earlier stage. In the cases of nasal involvement the tumor most frequently arose from the septum (Ohishi,[12] Miyoshi,[1] Higashi and Shiraiwa [14] and others), and tumor from the lateral wall (Knauer,[7] Fuzii [15]), turbinate body (Takahashi [11]) or vestibule (Gon [13]) followed. In Japan, out of 8 cases of septal involvement, there was only 1 case of lymphangioendothelioma, but this type was more

Comparison of the Frequencies Among Nasal and Paranasal Malignant Growths

Author	Location	Classification (cases) Carcinoma	Sarcoma	Endothelioma	Total	Year
Finder [4a]	Charlottenburg	2	10	0	12	1896
Hammer [4b]	Strassburg	5	12	3 (15.0%)	20	1895
Maljutin [4c]	Moscow	17	62	0	79	1901
Harmer and Glas [4d]	Vienna	25	6	1 (3.12%)	32	1908
Marschik Chiari [4e]	Vienna	30	12	2 (4.54%)	44	1914
Ferreri [4f]	Rome	19	44	1 (1.56%)	64	1914
Okonogi [4g]	Tokyo	16	6	0	22	1918
Tanaka [2]	Okayama	48	11	3 (4.83%)	62	1918
Denker [4h]	.....	25	13	0	38	1922
Tanaka [4i]	Sendai	67	11	4 (4.87%)	82	1935
Koshino [4j]	Tokyo (Keio)	5	9	1 (6.66%)	15	1936
Azumi and Kawamura [4k]	Nagoya	82 (sinus)	10	1 (1.07%)	93	1939
		6 (nose)	1	1 (12.5%)	8	
Rin and Ryu [4l]	Taihoku (Taipeh)	20	6	0	26	1941
Yeh and Tu [4m]	Taipeh	28 (sinus)	3	0	31	1949
		12 (nose)	4	1 (5.88%)	17	

frequently found in the other reports, and of septal hemangioendothelioma, only 1 case each by Roth [17] and Jofis [17] was recorded in the literature (exclusive of the Japanese). Knauer [7] reported a case in which two walnut-sized tumors were removed from the left middle meatus in a woman aged 49 (hemic type). Fuzii's [15] case concerned a lymphangioendothelioma developing from the lateral wall of the right nasal cavity just anterior to the inferior turbinate body in a 54 year old man; the growth weighed 3.9 Gm.

14. Higashi, Y., and Shiraiwa, N.: Hemangioendotheliomas of the Nasal Septum, Oto-Rhino-Laryng. (Tokyo) **14**:638, 1941.

15. Fuzii, K.: Endothelioma of the Nose, Oto-Rhino-Laryng. (Tokyo) **15**:829, 1942.

16. Awataguchi, S.: Endothelioma of Lymphoduct in Maxillary Sinus, Oto-laryngology (Tokyo) **21**:1:20, 1949.

17. Roth, and Jofis, cited by Higashi and Shiraiwa.[14]

The classification and histogenesis of endothelioma, which was first named by Golgi in 1869, have been in dispute for a long time among pathologists (Ribbert, Pyrm, Volkmann, Hansemann, Borst and others). Recently, Harvey, Dawson and Innes[18] stated in their descriptions, after studying more than 500 cases, that the endothelioma was either a congenital mesodermic malformation (dysgenetic field), having a tendency to disproportionate growth, or a primary neoplasm. The term endothelioma was used somewhat differently from its older and original meaning. They classified the tumor morphologically as follows:

1. Primordial

2. Vasoformative—Hemic, with varieties (arterial, capillary, cavernous, arteriovenous, venous or mixed), and lymphatic, with similar possible variations as that of the hemic

3. Membranoformative

According to their classification, the tumor in the present report may correspond to the lymphatic capillary endothelioma.

SUMMARY

A report is presented of a typical lymphangioendothelioma as a primary growth in the nose and as an addition to the few similar cases found in the literature.

Histologically, it had a benign feature, according to Harvey's[18] description. The patient had a successful clinical course. A brief review was made on the classification and histogenesis of the endothelioma.

Prof. S. Yeh and Dr. T. Chen advised and assisted me in the pathologic field.

18. Harvey, W. F.; Dawson, E. K., and Innes, J. R. M.: Debatable Tumors in Human and Animal Pathology, Cancer Control Organization of Edinburgh and South-East Scotland, 1940.

Case Reports

ATTEMPTED FENESTRATION OPERATION IN A CASE OF ABSENCE OF LUMEN OF SEMICIRCULAR CANALS

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HILLERØD, DENMARK

Nowadays, the fenestration operation is an approved surgical procedure in all modern otologic clinics and is performed not exclusively in otosclerosis but also in other conditions affecting the conduction apparatus. This paper is presented as an appeal always to submit the patient to a thorough examination, especially vestibular, before the fenestration and as a demonstration of what may happen if these natural precautions are neglected.

REPORT OF A CASE

A girl 14 years of age was admitted to Frederiksborg County Hospital on Jan. 24, 1949. She was extremely well developed for her age. As a child, she had had scarlet fever and measles, but without aural complications. When she was 2 years old a bilateral mastoidectomy had been performed by another physician, but unfortunately it has been impossible to obtain the case record. Since then the ears have been dry, but the patient has been very hard of hearing, which has been a great handicap in her education. Consequently, she and her parents earnestly wished a fenestration operation to be performed if possible.

The ears were dry, the drum membranes normal. Hearing for the whispered voice was 0/0 and for speech, a.a./1.00, every precaution being taken to mask the nonexamined ear. Many corresponding tests indicated that the patient really could hear on both sides, especially the right.

There was no spontaneous nystagmus. After five rotations to the right the nystagmus to the left lasted twenty and thirty seconds respectively in two subsequent tests; after five rotations to the left nystagmus to the right lasted ten and fifteen seconds respectively. On roentgenograms, the cavities resulting from the mastoidectomies were clearly defined, without any signs of osteitis.

On the diagnosis of sequelae of otitis media, a fenestration operation was attempted on the right side. The cavity was dry and shining, without any granulations; the incus, however, was missing. The operation, according to Lempert, proceeded smoothly, and the lateral and superior semicircular canals were exposed. In the attempt to make the fistula, however, the bony capsule of the lateral semicircular canal was, in the beginning, considered to be very thick, but it soon became evident that there was no lumen at all. In subsequent attempts to place the fistula first on the superior then on the posterior canal, it was found that there was no lumen in these canals either, the whole area being a hard, ivory-like, bony mass. As the patient was under local anesthesia, a caloric test with sterile ice water was done, but no nystagmus appeared. The flap was placed in the usual position, and the cavity healed quickly. On reexamination ten months later, the cavity was found to be smooth and dry

and the patient could still hear speech ad concham, every precaution being taken to mask the other ear.

Epicrisis.—A girl 14 years of age had been very hard of hearing as a result of a bilateral otitis media occurring when she was 2 years old, and consequently,

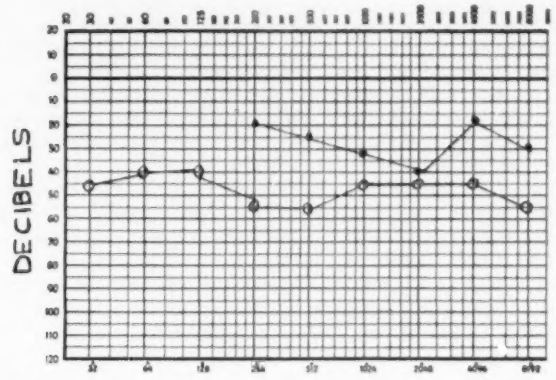

Chart 1.—Audiogram of the left ear, with masking at 110 decibels, made on Jan. 3, 1949. As in chart 2, the first line indicates bone conduction, the second, air conduction.

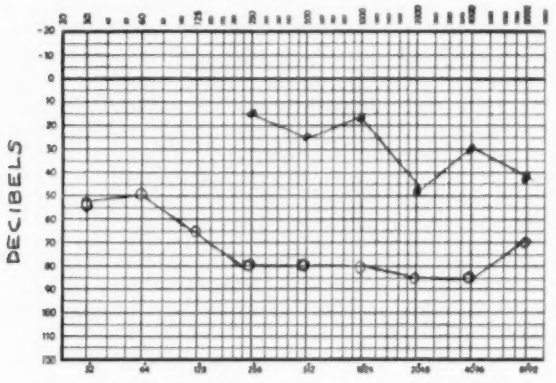

Chart 2.—Audiogram of the right ear made on January 24.

she had been very handicapped in her education. As the hearing by bone conduction was good and the drum membranes without perforations, a fenestration operation was attempted. No lumen was found in any of the semicircular canals on the side operated on.

COMMENT

What is being dealt with here? Two possibilities must be considered.

1. The first possibility is that the semicircular canals may have been normal earlier, but as a result of a previous insidious labyrinthine infection they may gradually have become ossified. Rasmussen [1] in his thesis has shown microscopically that such a process, a labyrinthitis ossificans, may take place. Against this assumption arises the fact that the bony structure of the canals was absolutely smooth throughout their entire thickness, the lumen being not as in Rasmussen's case partly obliterated, partly filled with connective tissue and newly formed bone. Thus, the patient in the present case was able to hear, but the labyrinthine infection may have started in the semicircular canals, perhaps resulting from a lesion during the mastoidectomy, previously performed, completely destroying the canals but leaving the cochlea partly intact.

2. The other possibility is that here one may be dealing with an aplasia of the labyrinth. This extremely rare condition has been described in older textbooks (Broman,[2] Corning,[3] Albrecht,[4] Henke-Lubarsch [5]), but in modern books on embryology it is not even mentioned. If the present case is to be placed in this category, it must be a partial aplasia, mainly affecting the semicircular canals since the hearing was not completely abolished on this side.

CONCLUSIONS

It is impossible to tell with certainty whether or not one is confronted here with a case in which the labyrinth had been previously normal but later on, through a labyrinthitis ossificans, became obliterated or with a labyrinthine aplasia. The main problem, however, is whether this unsuccesful operation could have been avoided. This question is very easily answered in the affirmative.

The first hint of the missing function of the semicircular canals was given by the rotation test, which showed a marked difference in turning the patient to the right and to the left. This hint, however, was overlooked, and, what is worse, it was forgotten to perform the usual caloric test. Furthermore, in revision of the roentgenograms, it was evident that the lumen of the semicircular canals was missing on the side operated on but normal on the other.

Judging from the present case, the paramount importance must be stressed of a thorough examination with special attention paid to the labyrinthine function of all patients for whom a fenestration operation is planned.

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1. Rasmussen, H.: Histologiske undersøgelser over betændelser i tindingebenet, særligt i pars petrosa, Copenhagen, Ejnar Munksgaards Forlag, 1943.

2. Broman, I.: Normale und abnorme Entwicklung des Menschen, Wiesbaden, J. F. Bergmann, 1911, p. 774.

3. Corning, H. K.: Lehrbuch der Entwicklungsgeschichte des Menschen, Munich, J. F. Bergmann, 1921, p. 593.

4. Albrecht, W.: Erbbiologie und Erbpathologie des Ohres, in Just, G., and others: Handbuch der Erbbiologie des Menschen, Berlin, Julius Springer, 1940, vol. 4.

5. Henke, F., and Lubarsch, O.: Handbuch der speziellen pathologischen Anatomie und Histologie, Berlin, Julius Springer, 1925, vol. 12, p. 682.

SUMMARY

A girl 14 years of age was very hard of hearing after a bilateral otitis media that occurred when she was 2 years old. As the hearing by bone conduction was good and the drum membranes were without perforations a fenestration operation was attempted. Although the exterior of the semicircular canals was normal, no lumen was found in any of them, and the labyrinth did not respond to a test with ice water during the operation. It is discussed whether this condition is the result of a labyrinthitis ossificans or a labyrinthine aplasia. The operation might have been avoided if proper attention had been paid to the result of the rotation test and to the roentgenograms and if it had not been forgotten to perform the usual caloric test before the operation. The paramount importance of a thorough vestibular examination of all patients intended for a fenestration operation is emphasized.

Frederiksborg County Hospital.

Progress in Otolaryngology

Summary of the Bibliographic Material Available in the Field of Otolaryngology for 1948

PERORAL ENDOSCOPY

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PHILADELPHIA

WHILE anatomic and physiologic studies cannot always be applied immediately on a clinical basis, it nevertheless is important that these observations are made and recorded. With this information available the clinician often is guided in his investigations and observations.

PHYSIOLOGY OF TRACHEOBRONCHIAL TREE

Although generally conceded that the nose is an effective air cleanser, particles of dust do get beyond this into the peripheral portion of the lung. This brought up the question to Hilding and Hilding[1] whether there is any other air cleanser lower in the tract. They made a study of measurements on the bronchial tree using lungs removed at necropsy.

They found that there is a small progressive increase in the volume of the tracheobronchial tree from the larynx to the bronchi, measuring 1.5 mm. in diameter. The increase is from 50 to 100 per cent. In this portion of the tree there does not seem to be any very effective air cleansing device except that of the direct impingement of the air on the mucous blanket lining the tree. From the fragmentary data available, there seemed to be very considerable expansion in the volume of the tract in tubes less than 1.5 mm. in diameter. Before the cilia cease, the tree has divided into bronchioles, which number at least between 15,000 to 70,000, each of which is lined with ciliated epithelium and a sticky mucous blanket. The composite circumference of these tubes measures many meters.

This, "the bronchiolar filter," is an effective, final device to protect the alveoli from dust and fumes that might gain access to the trachea. One infers that the cilia move off the mucous blanket, as is the case elsewhere in the tract. One might also infer that this bronchiolar filter could be even more effective in the matter of dust removal and humidi-

1. Hilding, A. C., and Hilding, D.: The Volume of the Bronchial Tree at Various Levels and Its Possible Physiologic Significance, Ann. Otol., Rhin. & Laryng. **57**:324 (June) 1948.

fication than the nose if sufficient secretion is produced. It does not, of course, protect the trachea and the larger bronchi from improperly prepared air.

BRONCHOSPIROGRAPHY

The subject of bronchospirometry, the procedure by which function of the separate lungs may be determined simultaneously, is one which concerns the bronchologist, not only because of his interest in bronchopulmonary pathology but also because he will see many patients in whom functional tests are indicated and because he undoubtedly will be called on to participate in the procedures by which clinical data are obtained. It is now generally recognized that determination by external spirography of the combined function of the two lungs is of limited clinical value in many cases. The thoracic surgeon is interested in the ability of the patient to withstand unilateral procedures, and only by a simultaneous determination of the functional capacity of the separate lungs can it be shown whether the contralateral lung is capable of assuming what function is lost either temporarily or permanently on the side operated on. Norris and his associates [2] discussed the technic of bronchospirography and recorded their observations with a group of cases of bronchopulmonary pathologic lesions.

The contraindications to bronchospirography are few. Instrumentation is inadvisable in the presence of laryngeal tuberculosis or tuberculosis of the trachea or the left bronchus, which, if present, would have been noted on indirect laryngoscopy or bronchoscopy. Lesions of the left bronchus will interfere with positioning of the catheter. Dyspnea of moderate or marked degree is a relative contraindication, depending on the importance of the procedure in a given case. Secretions too can be considered as a contraindication, but they may be aspirated through the single lumen catheter by means of a small caliber rubber tube.

The data obtained by bronchospirography are intended to supplement and should not be regarded as displacing in importance the information gained by external spirography, in which the combined function of the two lungs is recorded. The chief value of the procedure is in allowing an estimate of the ratio in which the separate lungs participate in the various phases of total respiratory function.

ANESTHESIA

Although all forms of anesthesia, including general as well as local, have been tried in peroral endoscopic procedures, it is generally agreed that local anesthesia is more efficient because it allows the patient to cooperate and avoids the toxic side effects of general anesthesia. King

2. Norris, C. M.; Long, J.; Oppenheimer, M. J., and Wester, M. R.: Bronchospirography: Indications and Technic, Ann. Otol., Rhin. & Laryng. **57**:828 (Sept.) 1948.

and Jones [3] have attempted several plans of local anesthesia, which included a combination of cocaine with tetracaine hydrochloride U. S. P. (pontocaine hydrochloride®) and later Forrestier's solution.[3a] By these methods satisfactory anesthesia was secured, but, unhappily, two deaths occurred. A method then was evolved which included premedication with use of secobarbital (seconal®), 0.1 Gm., two hours and one hour prior to examination, together with morphine, 15 mg., and atropine, 0.4 mg., forty-five minutes prior to examination. Four cubic centimeters of a 4 per cent solution of cocaine was then used, the first cubic centimeter being instilled by an atomizer intranasally for pharyngeal anesthesia, which, at the same time, provided a test for sensitivity. After a five minute interval, 1 cc. of the cocaine solution was instilled with a laryngeal syringe, drop by drop, on the base of the tongue, the vallecula, the lingual surface of the epiglottis, the laryngeal surface of the epiglottis and, finally, directly into the larynx. With intervals of five minutes, these instillations were repeated for a total dosage of 3 cc.

In esophagoscopy, the pharyngeal spray was used in the same manner and often was found to be sufficient in itself. One cubic centimeter of the cocaine solution could be instilled into the piriform sinuses if needed.

Since this method was instituted 313 procedures were carried out without toxic reaction. In 3 instances it was necessary to resort to general anesthesia. Although too early to state definitely about the possibility of toxic reactions, this method proved satisfactory from the standpoint of anesthesia, and it is hoped that severe toxic reactions may be avoided.

Harken and Salzberg [4] recommended transtracheal anesthesia by instillation of 9 cc. of a 0.3 per cent tetracaine hydrochloride solution injected in fractionated doses through the cricothyroid membrane into the trachea to secure anesthesia for bronchoscopy. After an experience with 1,000 bronchoscopies they found this method superior to other methods of administering topical agents and also to general anesthesia.

Ninety minutes before examination pentobarbital sodium U. S. P. is given by mouth, followed in one-half hour by codeine sulfate. In ten or fifteen minutes before the intratracheal anesthesia is introduced, the lips,

3. King, J. W., and Jones, D. H.: Anesthesia in Endoscopy, Laryngoscope **58**:1195 (Nov.) 1948.

3a. Forrestier's solution has the following composition:

	Gm. or Cc.
Cocaine hydrochloride	2.0
Phenol	0.2
Potassium sulfate	0.2
Epinephrine 1:1,000	10.0
Cherry-laurel water	40.0
Distilled water to make	150.0

4. Harken, D. E., and Salzberg, A. M.: Transtracheal Anesthesia for Bronchoscopy, New England J. Med. **239**:385 (Sept. 9) 1948.

mouth and pharynx are sprayed with a 2 per cent solution of tetracaine hydrochloride during deep inspiration. With the patient on his back and the head hyperextended, the thyroid membrane is identified and the skin and subcutaneous tissues are infiltrated with a 2 per cent procaine hydrochloride solution. The tetracaine then is injected directly into the trachea, in the amount of 4.5 cc. The patient is instructed to sit up and cough; he then lies down for five minutes, after which an additional 4.5 cc. of tetracaine hydrochloride solution is injected.

Complications almost never occur. While the method is suitable with active tuberculosis, they believe that it should not be used in extensive involvement of the larynx or trachea. The application of this procedure in bronchoscopy for removal of a foreign body depends on the position of the object.

CONGENITAL COMPLICATIONS IN THE NEWBORN

The use of bronchoscopy to solve some of the problems involved in respiratory disturbances in the newborn has received relatively little attention. Many bronchologists feel that additional lives may be saved and subsequent respiratory complications in infants may be reduced by the wider use of bronchoscopy in selected cases when the patient fails to respond promptly to other recognized procedures.

Heatley and Emerson[5] discussed conditions interfering with the establishment of normal respiration in the newborn. They expressed the opinion that bronchoscopy can be performed with safety in these patients. In selected cases of respiratory obstruction and atelectasis with failure to respond to conservative treatment bronchoscopy is definitely indicated. In these cases it may not only prove to be lifesaving but by removing obstructions in the tracheobronchial tree may reduce the complications from persistent atelectasis. A series of 50 bronchoscopies performed in newborn infants was reviewed. Indications in all were clinical evidence of respiratory distress persisting in spite of the commonly employed methods of conservative treatment. The majority of the bronchoscopies were performed within the first twenty-four hours of life. In the authors' experience, bronchoscopy produced little, if any, shock, and these results coincide with reports of other observers.

One of their most interesting cases was that of an infant with a tracheoesophageal fistula. Successful surgical closure was carried out on the third day of life. An important part of the successful management of this case was the careful bronchoscopic aspiration of secretions, both preliminary to and following operation. They stated the belief that bronchoscopy will play an increasingly important part in the management of similar surgical problems in the newborn.

5. Heatley, C. A., and Emerson, E. B., Jr.: Bronchoscopy in the New Born: An Analysis of Fifty Cases, Ann. Otol., Rhin. & Laryng. **57**:802 (Sept.) 1948.

CONGENITAL VASCULAR ANOMALIES

Recent achievements in thoracic surgery and advances in diagnostic technic have aroused new interest in congenital cardiovascular anomalies. Certain of these anomalies are now being routinely and successfully treated by operation, and the utilization of surgical methods in this field is rapidly being broadened. Holinger and his associates [6] presented a limited group of cardiovascular anomalies that produces respiratory dysfunction through compression of the trachea and bronchi. These anomalies may be divided into two major groups: first, malformations of the heart, usually major developmental defects with chamber enlargement sufficient to cause compression of the bronchi, and, second, anomalies of the aorta and its main branches. The commonest in this group was the double aortic arch and the constricting ring variety of the right aortic arch. Representative examples of cases of each of these groups were presented to illustrate the diagnostic and clinicopathologic aspects of this problem. While current medical literature stresses the diagnostic importance of roentgenography, routine roentgen studies may not reveal any distinctive findings. On the other hand, laryngoscopy and bronchoscopy may be most informative. In the initial phases of investigation other common causes of tracheobronchial obstruction can be excluded by endoscopic examination, and the exact site of compression often can be determined and may lead to an early diagnosis of a vascular anomaly. The indications for additional more specialized roentgen procedures may then be clarified and fulfilled. The complex nature of the disease and the serious prognosis of the patients in this group justify utilization of every diagnostic aid obtainable.

PULMONARY ATELECTASIS

While atelectasis is a serious problem when it occurs at any age, in the newborn the outcome is always critical and may be fatal unless relieved. In a discussion of this subject, Hill [7] expressed the opinion that aspiration of amniotic fluid coincident with or following a normal delivery or by cesarean section is the commonest cause of atelectasis in the newborn. There is some evidence to suggest that it occurs more frequently in infants delivered by cesarean section. Excessive maternal narcosis may likewise be a factor resulting in a depression of the infant's respiratory center.

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6. Holinger, P. H.; Johnston, K. C., and Zoss, A. R.: Tracheal and Bronchial Obstruction Due to Congenital Cardiovascular Anomalies, Ann. Otol., Rhin. & Laryng. **57**:808 (Sept.) 1948.

7. Hill, F. T.: Atelectasis in the Newborn: Case Report, Ann. Otol., Rhin. & Laryng. **57**:220 (March) 1948.

Cyanosis, possibly intermittent at first but progressively increasing, is the predominant sign and should indicate the probability of atelectasis. Shallow respiration, rapid pulse and absence of breath sounds are suggestive. When a question exists a roentgen examination should be made promptly, for if atelectasis is present this examination will confirm the diagnosis.

While the prompt use of suction to aspirate fluid may avoid atelectasis, it is not sufficient to relieve a definite bronchial obstruction unless applied with endoscopic control, and for that reason translaryngeal aspiration, preferably by bronchoscopy, should be instituted as promptly as possible.

In the case reported by Hill, a child born prematurely at 7 months had had difficult respirations since birth and was kept in the hospital in and out of an incubator for three months. Oxygen was required a great deal of the time. At the age of 4 months, when seen by Dr. Hill, there was definite clinical and roentgen evidence of atelectasis of the entire left lung with a mediastinal shift to the left. In addition, there was a healed fracture of the seventh rib on the left side. At bronchoscopy thick secretion was aspirated from the left bronchus with prompt clearing of the atelectasis and a return of the mediastinal structures to their normal position. This case is of interest because of the rib fracture, previously unrecognized and very probably resulting from delivery, which may have contributed to the cause of the atelectasis and, further, because of the persistence of the atelectasis for four months and its prompt clearing following bronchoscopic aspiration.

BRONCHOSCOPY IN GENERAL MEDICINE

In a review of bronchoscopy in clinical medicine and surgery, Penta [8] emphasized the following generally accepted facts: Aside from the well known procedure for the removal of aspirated foreign bodies, bronchoscopy has come to play an important role in the diagnosis and treatment of diseases of the lungs. There are many conditions of the lower respiratory tract that often remain undiagnosed because of lack of bronchoscopic study. In the diagnosis of primary carcinoma of the lung, bronchoscopic examination is by far the most important diagnostic procedure available. Close cooperation between the internist, radiologist and bronchoscopist will, in many instances, facilitate the diagnosis of obscure conditions of the lung. Many suppurative conditions of the lungs, if diagnosed early, will respond to bronchoscopic and medical management. Bronchoscopy is of aid in the removal of bronchial obstruction, thus preventing the development of atelectasis and subsequent pulmonary destruction. Bronchoscopy is of aid to the thoracic surgeon in the localization of pulmonary lesions.

8. Penta, A. Q.: The Role of Bronchoscopy in Clinical Medicine and Surgery, Dis. of Chest **14**:366 (May-June) 1949.

ACUTE LARYNGOTRACHEOBRONCHITIS

Although there still is a lack of agreement regarding the best methods of treatment of acute laryngotracheobronchitis, this clinical condition is generally recognized as a serious disease with a comparatively high mortality rate. In a report of 52 consecutive cases of this condition treated during the past five years, Davison [9] reported no deaths. The series included 15 patients who required tracheotomy. Since acute laryngotracheobronchitis usually begins as a primary subglottic laryngitis and the infection may be fulminating in character, tracheotomy cannot always be avoided. A majority of the cases are due to the pathogenic gram-positive cocci, and most of these organisms are sensitive to penicillin.

Davison attributed his low mortality rate in this series to the use of cool moist air provided by a humidified oxygen tent; adequate doses of penicillin or sulfadiazine, preferably the former; avoidance of instrumental trauma to the mucosa of the trachea and bronchi; postural drainage; early tracheotomy; transfusion when indicated and careful personal attention to each patient.

BRONCHIAL ASTHMA

In a discussion of the various procedures that may be used in the treatment of bronchial asthma, Segal [10] included bronchoscopy. He considered this a very valuable diagnostic and therapeutic procedure that is indicated whenever a harsh useless cough with retained secretions is present and bronchospasm persists despite adequate physiologic management. One of the commonest and important causes of death in asthma is obstruction of the larger and smaller air passages by inspissated tenacious secretion. He recommended the use of deep surgical anesthesia in preference to local anesthesia and vinyl ether U. S. P. (vinethene®) as a preliminary induction agent to ether. Oxygen should be used through the bronchoscope during anesthesia and bronchoscopy. With this technic intensive bronchoscopic aspiration followed by bronchial lavage with saline solution and finally instillation of a solution of penicillin and/or streptomycin in phenylephrine hydrochloride (neo-synephrine hydrochloride®) may prove of lifesaving value to the asthmatic patient.

In discussing bronchopulmonary infections in allergic persons, Davison [11] referred to those who, because of a hereditary predisposition,

9. Davison, F. W.: Acute Laryngotracheobronchitis: Further Studies on Treatment, Arch. Otolaryng. **47**:455 (April) 1948.

10. Segal, M. S.: Facts and Fancies in the Management of the Seriously Ill Patient with Bronchial Asthma, Dis. of Chest **14**:795 (Nov.-Dec.) 1948.

11. Davison, F. W.: Bronchopulmonary Infections in Allergic Individuals, Ann. Otol., Rhin. & Laryng. **57**:884 (Sept.) 1948.

react excessively to irritation, whether chemical, bacterial, mechanical or protein. In such persons the mucous membranes develop excessive edema and large amounts of exudate in response to stimuli which would not provoke these reactions in nonallergic persons. To evaluate the frequency and the significance of the allergic constitution in patients coming to a bronchologist, Davison studied the hospital charts of 100 nearly consecutive patients who had bronchoscopic examinations. Forty-nine of the 100 patients studied had a family history of allergic symptoms (asthma, hay fever, eczema and hives); a personal history of allergic symptoms (asthma, hay fever, eczema and hives); blood eosinophilia of 5 per cent or more; eosinophils in bronchial exudate (10 per cent or more), or nasal polyps.

To recognize and understand this problem the bronchologist must have some knowledge of allergy which will aid in planning adequate therapy. Bronchoscopic aspiration benefits patients with Loeffler's syndrome and other types of allergic pulmonary consolidation. Chronic bronchitis occurs chiefly in hypersensitive persons. Allergic management helps some patients who have bronchiectasis. Autogenous vaccine therapy is useful in treating many types of chronic bronchopulmonary infection in allergic persons, but extremely small doses should be used. Examination for eosinophils in bronchoscopic specimens should be a routine procedure in patients with a chronic cough.

PULMONARY INFECTION IN PANCREATIC DISEASE

In the differential diagnosis of chronic pulmonary infections of childhood, Atkins [12] directed attention to the occurrence of an associated fibrocystic disease of the pancreas. In addition to the symptoms referable to the gastrointestinal tract, these patients are prone to repeated infections of the upper respiratory tract, chronic bronchitis, bronchopneumonia and bronchiectasis. Respiratory symptoms sometimes dominate the clinical picture and resemble chronic respiratory infection due to other causes. Bronchoscopic examination reveals pathologic changes which are sufficiently definite to suggest the diagnosis. Three interesting case reports together with the bronchoscopic findings are recorded.

MEDICATED AEROSOLS

In a study of patients treated with medicated aerosols, it was anticipated by Prigal [13] that highly effective absorption of the drugs would

12. Atkins, J. P.: Bronchoscopic Observations on the Pulmonary Aspects of Fibrocystic Disease of the Pancreas, Ann. Otol., Rhin. & Laryng. **57**:791 (Sept.) 1948.

13. Prigal, S. J.: Studies with Medicated Aerosols: The Use of the Lungs as a Portal for the Introduction of Therapeutic Agents for Systemic Effect, Ann. Int. Med. **28**:814 (April) 1948.

take place through the lungs, but it was not expected that there may be a temporary storage of the aerosol somewhere in the lung. Such an occurrence is the only way he could account for the prolonged blood levels obtained with sulfadiazine and penicillin. These observations led to the conclusions that other medication in aerosol form might possibly be introduced through the lungs for systemic purposes.

Studies of patients with asthma have disclosed that the aerosol method of administering aminophylline U. S. P. may at times succeed even after failure of aminophylline given intravenously. His review of previously reported studies of absorption through the lungs serves to call attention to the possible use of this organ as a means of introduction of medication not only for the treatment of local bronchopulmonary diseases but for systemic action as well.

In a follow-up report of their experiences with penicillin inhalation therapy, Hagens and his associates [14] discussed 10 patients with a chronic pulmonary condition who were given penicillin and streptomycin aerosol and 111 patients in a general hospital with a variety of diagnoses who were given penicillin aerosol inhalations alone.

The combination of penicillin and streptomycin aerosol therapy is of aid in most cases of bronchiectasis and chronic bronchitis but of less help in cases of asthma with a possible bacterial factor. Penicillin sodium and streptomycin may be nebulized together, but when penicillin calcium is used the two antibiotics must be nebulized separately, as the penicillin calcium produces precipitate particles in the presence of streptomycin which clog the nebulizer.

In their experience relatively few reactions or complications occurred as a result of the aerosol treatment. The number of complications was not greater than 5 per cent.

The clinical results varied with the cases. In pulmonary cases the method is useful as an adjunct to other forms of treatment or as an alternative when surgical intervention is not possible. In some cases of chronic bronchitis or bronchiectasis of the milder type, a periodic course of inhalation therapy may improve the patient's condition sufficiently to be quite beneficial and practical.

A method of administration of penicillin dust by inhalation was presented by Krasno and his associates.[15] Crystalline sodium penicillin processed to number 100 mesh particles was used in the experimental study. The type of apparatus used is described in detail, and the results of their findings in 66 subjects are recorded.

14. Hagens, E. W.; Karp, M., and Farmer, C. J.: Penicillin and Streptomycin Aerosol in the Treatment of Pulmonary Disease, Arch. Otolaryng. **47**:138 (Feb.) 1948.

15. Krasno, L.; Karp, M., and Rhoads, P. S.: The Inhalation of Dust Penicillin, Ann. Int. Med. **28**:607 (March) 1948.

Acute infections of the upper respiratory tract responded best. More than 90 per cent of the 23 patients with diseases of the upper respiratory tract exhibited decided improvement. Data showed that there was a marked diminution of gram-positive bacteria of the upper respiratory tract after the treatment. Coincident with treatment there was improvement in signs and symptoms in infections of the upper respiratory tract and bronchiectasis.

In many instances effective blood levels were demonstrated usually three to three and a half hours after inhalation. The method appeared to be more effective than any other method of inhalation of penicillin and caused fewer side reactions.

The preliminary results obtained with the inhalation of penicillin dust by Krasno and his associates [16] suggested that this is an effective and practical method in the treatment of many types of infection of the respiratory tract. The present report is a more extensive study of the procedure carried out on 357 patients. More conclusive information has been obtained on the incidence and nature of allergic reactions occurring with the method; an evaluation of the efficiency of this method has been obtained in a larger number of patients, and further refinements to increase its practicability for use in the home, office and hospital have been made.

The incidence of allergic reaction in 357 patients was from 3 to 6 per cent. The reactions were local in character, and it is believed that the gradual rate and extent of absorption of penicillin dust may account for the low incidence of penicillin reaction.

In inhalations, 100,000 units of penicillin dust were given one to three times daily. The therapy was continued at home for varying periods of time in all cases of bronchiectasis. Throat, nose and sputum cultures showed a decided diminution of the gram-positive bacteria, and in many instances the gram-negative bacteria decreased also.

While inhalation of penicillin dust almost invariably induced improvement in all types of bacterial infection in the upper part of the respiratory tract, the authors emphasized that it cannot always be relied on as the total treatment of these infections to the exclusion of parenteral administration and to local drainage of sinuses and bronchiectatic cavities.

BRONCHIECTASIS

In a study of bronchiectasis in children, Chattas [17] considered atelectasis, of common occurrence in childhood, as an important cause. It is obviously the duty of the pediatrician to recognize the presence of

16. Krasno, L.; Karp, M., and Rhoads, P. S.: Inhalation of Penicillin Dust, J. A. M. A. **138**:344 (Oct. 2) 1948.

17. Chattas, A.: Bronchiectasis in Children, Dis. of Chest **14**:437 (May-June) 1948.

bronchiectasis and to make every effort to remove its cause if possible. Bronchiectasis in the adult is a process which usually originated in the first few years of infancy, notably during whooping cough and measles. These changes may not be permanent, and in the prebronchiectatic stage medical treatment can sometimes be successful. If medical treatment fails bronchiectasis then becomes definitely established and is irreversible. Only by surgical treatment can a permanent cure be obtained.

Before the use of iodized oil U. S. P. for bronchography, bronchiectasis was often not recognized and many cases were incorrectly diagnosed as tuberculosis or unresolved pneumonia. At the present time a positive diagnosis can be made in almost every case. In a discussion of this subject Singer [18] stated that medical treatment at best is palliative, but sometimes patients may feel clinically well although the pathologic condition remains. Surgical procedure offers positive cure, particularly for young patients. With the general availability of thoracic surgeons in all medical centers and the low mortality rate, one should not hesitate to have a lobectomy or pneumonectomy done in suitable cases.

HEMOPTYSIS

In a large percentage of patients with hemoptysis the exact cause and source of the bleeding often is difficult to ascertain. Friedberg [19] directed attention to circulatory disturbances incident to pathologic conditions in the mediastinum as etiologic factors in obscure pulmonary hemorrhage.

Case histories of 2 patients with hemoptysis were presented. In 1, there was obliteration of the superior vena cava by an inactive calcified tuberculous mass. Passive congestion in the bronchial venous system and resulting abnormal bronchopulmonary circulatory anastomosis were thought to have been the principal factors responsible for hemoptysis. In the second patient tissue obtained bronchoscopically on several occasions suggested its proximity to a tuberculous lymph node. A calcified hilar mass obstructing the pulmonary vessel and partially involving the superior vena cava was found at operation. Pneumonectomy performed on the right side apparently has resulted in a cure of long-standing hemoptysis.

TUBERCULOUS TRACHEOBRONCHITIS

In a pathologic study of tuberculous tracheobronchitis made in 657 cases coming to autopsy, Sweany and Behm [20] found gross evidences of

18. Singer, J. J.: Bronchiectasis, Dis. of Chest **14**:92 (Jan.-Feb.) 1948.

19. Friedberg, S. A.: Hemoptysis Secondary to Chronic Mediastinal Venous Obstruction, Ann. Otol., Rhin. & Laryng. **57**:897 (Sept.) 1948.

20. Sweany, H. C., and Behm, H.: Tuberculosis of Trachea and Major Bronchi, Dis. of Chest **14**:1 (Jan.-Feb.) 1948.

tuberculosis in 377 cases. The incidence was increased in the young age group and in those of the female sex. The location of lesions in the tracheobronchial tree was more or less at random, although points of stress, such as the larynx, the posterior aspects of the tracheobronchial tree and areas near cavities, seem to be affected most. The hope for the future of the patient with tuberculous tracheobronchitis seemed to be for early bronchoscopic study of all cases, early diagnosis and early treatment by thoracoplasty or streptomycin or both.

One must consider that tuberculous tracheobronchitis is but a local manifestation of a systemic type of disease. While there is some difference as to the development of the endobronchial phase of the disease, it very probably is due to direct implantation in the mucosa either through breaks in the epithelium or in the glands. Stasis of secretions unquestionably favors this. In a discussion of this subect Judd [21] emphasized that the goal of good and effective treatment lies first in the discovery of the endobronchial lesions through more general employment of bronchoscopy for diagnosis and, second, in the judicious use of bronchoscopy and local medical measures together with procedures of collapse therapy.

In a study of tuberculosis, Dutra [22] reported on 342 cases of tuberculous tracheobronchitis in which 533 bronchoscopies were performed. He did not recommend the routine employment of bronchoscopy in tuberculosis unless there were definite indications. In his group the indications were noted in 21.6 per cent.

Tuberculous tracheobronchitis appeared to increase in frequency in direct ratio to increase in years of the patient. There was no appreciable variation in the frequency in relation to the stage of the disease, but tuberculous involvement of the tracheobronchial tree appeared to be commoner in cavernous tuberculosis, 68.8 per cent of his cases.

While silver nitrate, 30 percent, used as a cauterizing agent proved beneficial, Dutra expressed the opinion that it was not the solution to the problem and that, in all likelihood, streptomycin or other similar agents which acted simultaneously on the pulmonary process as well as the local disease in the tracheobronchial tree would give better results. Electrocoagulation, too, was considered a useful method, but there was great risk of producing stricture.

In the minds of many there always have been misgivings regarding the possibility of aggravating pulmonary tuberculosis by bronchoscopic

21. Judd, A. R.: Tuberculous Disease of the Trachea and Bronchi, Dis. of Chest. **14**:180 (March-April) 1948.

22. Dutra, M. R.: Tuberculous Tracheobronchitis, Rev. otorrinolaring. **8**:24 (March) 1948.

investigation. The literature contains data on the relative safety or danger of this type of examination.

In a study of the effect of bronchoscopy in a series of 473 cases, Coates [23] found that the incidence of roentgenographic increase of disease in the two months immediately following bronchoscopy was no greater than that in other two month periods before bronchoscopy. Bronchoscopic findings in 73 bronchoscopies followed within two months by roentgenographic increase, as compared to those in 400 cases in which such a postbronchoscopic increase was not shown, revealed essentially the same percentage of active endobronchial tuberculosis in the two groups. It was his impression that there was no tendency for postbronchoscopic increases to occur more readily than would be observed in a similar group not examined bronchoscopically. He emphasized that a few additional points should be mentioned, namely, that the first of these is the skill of the operator. This obviously plays a very important part in the evaluation of any group of postbronchoscopic reactions.

The use of streptomycin has definitely changed the concepts of management of tuberculous tracheobronchitis, and reports of its use are most encouraging, particularly since all prior forms of therapy have been comparatively ineffective. O'Keefe [24] reported the results of therapy in a series of 62 patients selected for treatment. In the selection of the patient two criteria were used: There was bronchoscopic evidence of mucosal disease, as manifested by persistent ulceration, granulations and stenosis, and roentgenographic signs of obstructive phenomena, as seen in atelectasis or in the ballooning of cavities following collapse measures. It was proved that all the patients were tuberculous.

Eleven patients received streptomycin by aerosol alone; 15 by concomitant aerosol and parenteral administration, and 36 by parenteral administration alone. The aerosol solution consisted of 15 mg. of the drug in 1 cc. of sterile isotonic sodium chloride solution administered by nebulization every two hours for a total daily dosage of 500 mg. Parenteral administration consisted of the intramuscular injection of 500 mg. twice daily. Larger parenteral dosages had been used originally, but because of untoward reactions total daily dosage was modified.

The results generally were impressive. In cases uncomplicated by obstructive effects, regression and repair of the bronchial lesions progressed with dramatic rapidity. Reexamination at intervals of four to six weeks often revealed complete healing of mucosal lesions and dissolution of granulation without the consequent development of cicatricial

23. Coates, E. O., Jr.: Bronchoscopy in Pulmonary Tuberculosis: A Study of Post-Bronchoscopic Increase of Disease, Am. Rev. Tuberc. **58**:412 (Oct.) 1948.

24. O'Keefe, J. J.: The Use of Streptomycin in Tuberculous Tracheobronchitis, Ann. Otol., Rhin. & Laryng. **57**:784 (Sept.) 1948.

stenosis. It was his opinion that the concomitant parenteral-aerosol method of administration of streptomycin appeared to be the method of choice.

The occurrence of partial or complete obstruction of a bronchus, particularly in a child, immediately suggests the presence of a foreign body. Vinson [25] stressed the importance of considering tuberculosis and reported the case of a child 1 year of age who exhibited certain symptoms that suggested foreign body. The history indicated that the child had been chewing on its shoelace. There was roentgenographic evidence of obstructive emphysema of the entire right lung.

Bronchoscopic examination revealed almost complete obstruction of the right bronchus by a granulomatous mass, which was subsequently diagnosed as tuberculous.

ASPERGILLOSIS

Pulmonary aspergillosis is uncommon and frequently is confused with tuberculosis. In the 2 cases reported by Gerstl and his associates [26] an aspergillus was the sole predominant infective agent, but the symptomatology and the roentgen ray appearances differed markedly. In 1 of the cases a bronchoscopic examination was performed and indicated no abnormalities. Lesions were not seen in the oral or nasal pharynx, and swabs implanted on Sabouraud's medium yielded no growth. It was believed, therefore, that this was a tuberculous rather than a neoplastic lesion. Because of recurrent hemoptysis, the upper lobe of the left lung was removed, and in the course of the study of this material the true nature of the disease was ascertained.

SCLEROMA

The finding of obstructive tumors in the trachea and bronchi which presented the characteristic histologic picture of rhinoscleroma in 2 patients led Tapia y Acuna [27] to consider the necessity of examining bronchoscopically most of the patients in whom typical rhinoscleroma was present. As a result, he found 1 case in which the scleroma probably was primary in the bronchus.

His experience with streptomycin was not sufficient to warrant a true evaluation of its efficacy. Radiotherapy, which gives excellent results in rhinoscleroma and in certain cases of laryngeal scleroma, failed in his

25. Vinson, P. P.: Bronchial Tuberculosis Simulating Foreign Body in a Child One Year of Age: Report of a Case, Am. Rev. Tuberc. **58**:207 (Aug.) 1948.

26. Gerstl, B.; Weidman, W. H., and Newmann, A. V.: Pulmonary Aspergillosis: Report of Two Cases, Ann. Int. Med. **28**:662 (March) 1948.

27. Tapia y Acuna, R.: Endoscopic Aspects of Bronchial Scleroma (Rhinoscleroma), Ann. Otol., Rhin. & Laryng. **57**:894 (Sept.) 1948.

series of cases of bronchial scleroma. In his experience endoscopic removal or operation by the external method is the best that can be offered. Dilation is very helpful during the phase of fibrosis. In spite of all known treatments there are recurrences.

SYPHILIS OF BRONCHUS

Although the early medical literature contained many references to pulmonary syphilis, with improvement in diagnostic procedures, the number of cases has declined and reports are seen infrequently. In the case reported by Judd,[28] the impressions gained from the gross appearances of the tumor at the time of the first bronchoscopy immediately suggested primary bronchogenic carcinoma. Histopathologic examination of the tissue, however, failed to corroborate the diagnosis, and this, in conjunction with a highly positive serologic reaction for syphilis, established the true nature of the tumor. Further examination of the tissue revealed spirochetes in the material. The diagnosis was further corroborated by a prompt and favorable response of the patient to antisyphilitic treatment.

COMPLICATIONS FOLLOWING ENDOTRACHEAL INTUBATION

Despite the large number of anesthetics administered endotracheally, few cases of complications due to laryngeal trauma have been reported. Hill[29] reported the case of a man who, five months previously, had undergone a two stage operation, the anesthesia time for the first stage being five hours and for the second, four hours. A soft rubber catheter (size 32 French scale) had been used. Hoarseness developed two months later. Examination revealed two sessile granulomas, one attached to each cord. These growths were removed with local anesthesia by direct laryngoscopy, and the diagnosis of granuloma was confirmed histologically. Recurrence on one cord required a subsequent laryngoscopic removal.

While the occurrence of granuloma does not imply criticism of this form of anesthesia, it is important that every patient with development of hoarseness after intratracheal anesthesia be examined with the possibility of granuloma in mind.

LARYNGEAL COMPLICATIONS OF IRRADIATION

With the use of roentgen irradiation in the treatment of carcinoma, it is expected that normal tissues, too, will be subjected to

28. Judd, A. R.: Syphilitic "Tumor" of the Right Bronchus: Case Report, Ann. Otol., Rhin. & Laryng. **57**:858 (Sept.) 1948.

29. Hill, F. T.: Granuloma of Larynx Following Endotracheal Anesthesia, Ann. Otol., Rhin. & Laryng. **57**:910 (Sept.) 1948.

excessive amounts of irradiation and that not infrequently unfavorable effects will be observed. In the treatment of benign lesions dosage must be controlled and appropriate filtration used so that only a slight local or systemic reaction is secured. Among roentgenologists, irradiation of the thyroid gland for hyperthyroidism is definitely indicated, but overdosage must be strictly guarded against since the object of treatment is for physiologic effects only.

Lukens [30] discussed the complications following irradiation for diseases of the thyroid gland and reported a series of cases in which extensive complications involving the larynx and trachea occurred. The results of this indiscriminate and uncontrolled use of irradiation resulted in reactions in the larynx and, particularly in the trachea, consisting of webs and cicatricial stenosis of the tracheal lumen and atrophy of the tracheal mucosa. In several instances tracheotomy was necessary. He emphasized the importance of avoiding any surgical procedures in the area of devitalized tissue whenever possible since, because the vascular supply is greatly diminished, resistance to infection is lowered and, in many instances, necrosis and gangrene of the operative field results.

TRAUMA TO BRONCHUS

In a discussion of rupture of a bronchus and a report of 3 cases with recovery, Holinger and his associates [31] concluded that bronchial rupture is a relatively rare complication of severe nonpenetrating external trauma to the chest. Cases of survival of such major injuries are now being clinically recognized with increasing frequency.

In a majority of persons traumatic bronchial rupture inevitably results in cicatrization which is complete. The pathologic sequelae in those with residual complete bronchial stenosis is a chronic atelectatic lung with reduction in respiratory function. It is remarkable to note that there is practically always a complete absence of complicating infections in these cases.

The diagnosis in the intermediate and late clinical phases is dependent on a history of severe trauma to the chest, the discovery of a persistent lung collapse and the bronchoscopic and bronchographic findings of complete occlusion of a bronchus.

In the initial phase of bronchial rupture, treatment of the concomitant chest injury is the primary concern. The possibility of early surgical repair of disruption of the bronchus warrants further investigation.

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30. Lukens, R. M.: Complications Following Irradiation of the Thyroid Gland, Ann. Otol., Rhin. & Laryng. **57**:633 (Sept.) 1948.

31. Holinger, P. H.; Zoss, A. R., and Johnston, K. C.: Rupture of Bronchus Due to External Chest Trauma: Report of Three Cases with Recovery, Laryngoscope **58**:817 (Aug.) 1948.

Management of old bronchial injuries is handicapped by the lack of basic cardiopulmonary studies. Therapeutic pneumothorax and thoracoplasty are recommended under certain specific conditions. Resection is indicated in the rare case in which complicating pulmonary infections develop.

A case of traumatic bronchial rupture with occlusion was reported by Hodes and his co-workers.[32] The bronchial tear followed a severe automobile injury, and subsequent bronchial occlusion and collapse developed on healing. Complete occlusion of the right main bronchus was demonstrated by bronchoscopy and bronchography. After surgical removal of the lung the right bronchus was found to be occluded by a thin smooth red membrane, with the remaining portion of the right bronchus patent.

Longmire[33] reported his observations in the reconstruction of a traumatic defect of the trachea 2.5 to 3 cm. in length with restoration of a normal airway and adequate phonation. He employed an acrylic prosthesis and later replaced this with a hollow lucite tube, which was inserted into the trachea, thus permitting a substitute tracheal wall to regenerate about the inner tube, which temporarily bridged the defect.

BRONCHIAL NEOPLASMS

The diagnosis and treatment of tumors of the lower respiratory tract is a splendid example of the close relation between many different branches of medicine and surgery. In a report covering a large series of cases, Broyles[34] emphasized certain important points in diagnosis.

Dyspnea may be due to partial occlusion of the trachea. A laminagraph may help in determining the extent of the growth. Frequent hemoptysis beginning and ending suddenly is a common symptom of a bronchial tumor, frequently a cylindroma or an adenoma. Atelectasis of an entire lung or any part of it is caused by occlusion of a bronchus. Only the upper portion of a tumor is seen through the bronchoscope if the lumen of the bronchus is filled.

A sputum test positive for tubercle bacilli or a Wassermann test with a positive reaction does not exclude the possibility of other diseases of the lung. Iodized oil U. S. P., when placed in a bronchus occluded by a tumor, forms a characteristic pool and roentgen shadow at the site of the lesion. A secondary infection may completely obscure an under-

32. Hodes, P. J.; Johnson, J., and Atkins, J. P.: Traumatic Bronchial Rupture with Occlusion, Am. J. Roentgenol. **60**:448 (Oct.) 1948.

33. Longmire, W. P., Jr.: The Repair of Large Defects of the Trachea, Ann. Otol., Rhin. & Laryng. **57**:875 (Sept.) 1948.

34. Broyles, E. N.: Bronchoscopic Experiences with Tumors of the Lower Respiratory Tract, Ann. Otol., Rhin. & Laryng. **57**:129 (March) 1948.

lying new growth. Cytologic study of bronchial mucus has aided in the early diagnosis of pulmonic cancerous lesions. An endoscopic examination can be the solution of a most complicated pulmonary picture.

In the treatment of carcinoma, bronchoscopic exploration offers practically no hope for cure, whereas benign tumors may be successfully removed by this method. When a diagnosis of carcinoma has been made the question of surgical extirpation, either by lobectomy or pneumonectomy, should be given consideration at once, since this is the only method by which a cure may be secured.

FIBROMA OF TRACHEA

Fibroma of the trachea is a rare tumor. In a study of this condition Knight and Bunting [35] found records of 36 reported cases.

In the case reported by them, the patient, a youth aged 20, complained of dyspnea and wheezing with bloody sputum. The physical examination indicated no abnormalities. A lateral roentgenogram revealed a mass protruding into the tracheal lumen from the posterior wall approximately 5 cm. below the larynx. At bronchoscopy the tumor was readily visualized as a large lobulated reddish mass attached to the tracheal wall by a pedicle about ½ inch (1.27 cm.) in diameter. The tumor was removed by external incision. A diagnosis of soft fibroma of the trachea was made.

Statistically, fibroma is the third commonest benign tracheal tumor, being superseded by papilloma and chondroma, osteoma and the tracheopathia osteoplastica group.

BRONCHIAL ADENOMA

A report from the Lahey Clinic by Souders and Kingsley [36] indicated that benign bronchial adenomas constitute 6.9 per cent (15 cases) of all pathologically proved primary bronchial tumors. Characteristically, they occur in the primary bronchi, are seen in young adults and have a slightly greater incidence in the female. Cough, hemoptysis and varying degrees of bronchial obstruction with their sequelae constitute the cardinal factors in their symptomatology. Discussion relative to the histopathology of these tumors indicates that opinion concerning their essential nature is well divided. Two types are recognized: the carcinoid, and the cylindroma (mixed tumor). In spite of their apparent benign nature, many consider them as either potentially malignant or of low grade malignancy.

35. Knight, J. S., and Bunting, W. P.: Fibroma of the Trachea, Arch. Otolaryng. **47**:67 (Jan.) 1948.

36. Souders, C. R., and Kingsley, J. W.: Bronchial Adenoma, New England J. Med. **239**:459 (Sept.) 1948.

A factor of significance in determining the management of patients with bronchial adenoma is the presence of extrabronchial extensions. Although this condition is generally conceded to occur in approximately 90 per cent of patients, their report showed this to be so in only 7 of their 15 cases. The presence of such extrabronchial tumors indicates that lobectomy or segmental lobectomy is the type of curative therapy.

Bronchoscopic removal with or without electrocauterization should be reserved for those which show no evidence of such extrabronchial extension.

Clerf [37] reviewed the outcome of the series of 35 cases with diagnosis of adenoma of the bronchus previously reported and added an additional series of 20 cases. He concluded that although bronchial adenoma may be a potentially malignant tumor this has been observed only once in the series of 55 cases.

The plan of treatment should be based on the bronchoscopic findings and roentgen studies, notably body section roentgenography and bronchography. If the findings indicate that the tumor is endobronchial, if there is an absence of bronchiectasis and if removal of the tumor is possible by bronchoscopic means this probably will suffice. Periodic bronchoscopic examination should be made. In the presence of certain indications, notably in tumors inaccessible to bronchoscopy; in cases in which one cannot establish and maintain an adequate airway whether or not there is evidence of extrabronchial tumor, and in hemorrhage and bronchiectasis with pulmonary fibrosis beyond the site of the tumor, surgical treatment is indicated.

Fifteen cases of adenoma of the bronchus were reported by Naclerio and Langer.[38] Although bronchoscopy was the most decisive single diagnostic procedure, histologic verification was not always made because the biopsy specimen in some instances did not contain tumor cells but only overlying epithelium and stroma, and in other cases biopsy was not performed because of the possibility of severe and fatal hemorrhage. Treatment consisted of lobectomy or pneumonectomy. The authors stated the belief that bronchoscopic treatment by electrocoagulation, forceps removal or implantation of radon seeds should be used only in patients who refuse surgical procedure or as a temporary measure to improve drainage.

The following conditions were listed as disadvantages of bronchoscopic treatment: local recurrence after removal; technical difficulties because of size and broad implantation; incompleteness of removal; danger of fatal hemorrhage; persistence of irreversible suppurative changes distal to the growth, and the presence of regional metastasis.

37. Clerf, L. H.: Adenoma of the Bronchus, Ann. Otol., Rhin. & Laryng. **57**:869 (Sept.) 1948.

38. Naclerio, E. A., and Langer, L.: Adenoma of the Bronchus, Am. J. Surg. **75**:532 (April) 1948.

BRONCHIAL HAMARTOCHONDROMA

Endobronchial polypoid hamartochondromas comprise only a small portion of all hamartomas of the lung. Postlethwait and his associates [39] found only 13 cases of this type reported in the literature. Endobronchial polypoid hamartochondromas produced symptoms by partial or complete bronchial obstruction, and pneumonitis, bronchiectasis or lung abscess may follow. The diagnosis is made by bronchoscopy and roentgen examination, with or without bronchography. Bronchoscopic removal was successful in 5 patients, and lobectomy was performed in the 1 case herein reported because of inaccessibility of the tumor by bronchoscopy. In the remaining cases either the growth progressed to a fatal issue or the tumor was an incidental finding at autopsy.

CARCINOMA OF TRACHEA

In reporting *2* cases of carcinoma of the trachea, Engler [40] discussed certain points of interest, particularly from the diagnostic standpoint. In the first case there was a history of dyspnea, wheezing and hemoptysis, clearly indicating that there was need for investigation, but because of absence of roentgenographic changes of the chest bronchoscopic investigation was advised against. When the patient was examined by Engler several days later he found a large fungating mass in the trachea, which explained the symptoms of dyspnea, wheezing and hemoptysis. In the second case an emergency tracheotomy was performed for obstructive dyspnea before an opportunity was had to examine the patient carefully, indicating that her symptoms of progressive tracheal stenosis had been either overlooked or misinterpreted.

BRONCHOGENIC CARCINOMA

Norris [41] studied the case records of a large series of patients with carcinoma of the bronchus with a view to emphasizing certain of the early clinical features and with the hope that these would aid materially in arriving at a diagnosis earlier. A survey of the records revealed that there were many delays in diagnosis that could have been avoided if the indications for roentgen study, bronchoscopy and other diagnostic procedures had been properly appreciated. Early manifestations of bronchogenic carcinoma may easily be confused with a variety of

39. Postlethwait, R. W.; Hagerty, R. F., and Trent, J. C.: Endobronchial Polypoid Hamartochondroma, Surgery **24**:732 (Oct.) 1948.

40. Engler, C. W.: Carcinoma of Trachea, Ann. Otol., Rhin. & Laryng. **57**: 429 (June) 1948.

41. Norris, C. M.: The Clinical Features of Bronchogenic Carcinoma: Illustrative Cases, Dis. of Chest **14**:198 (March-April) 1948.

other common diseases of the chest, and this might explain delays in diagnosis.

Of interest was a positive bronchoscopic biopsy in 221 cases (71.3 per cent) in the total group of 310 cases and resectability of only 12.9 per cent in a series of 269 consecutive proved cases.

Call and Vinson [42] reported a case of hemoptysis simulating primary bronchogenic carcinoma. The patient had active pulmonary bleeding for six days, with roentgenograms indicating diffuse infiltration at the base of the right lung extending from the hilar area and interpreted as primary bronchial cancer. At bronchoscopy, blood was observed arising from a posterolateral subdivision of the bronchus of the lower lobe of the right lung. After control of the bleeding, which was believed to come from a simple bronchial erosion, complete clearing of the pulmonary roentgenogram developed within a month.

While a positive diagnosis based on bronchoscopic biopsy can be made in a large proportion if not all of the carcinomas occurring in the larger bronchi, the occurrence of peripheral lesions renders visualization by bronchoscopy impossible.

In a series of cases reported by Ochsner and his associates,[43] a positive diagnosis was obtained by bronchoscopic biopsy in only 39.9 per cent of 195 cases with resection. In approximately the same proportion of cases the lesions in the resected specimens were found to be within range of bronchoscopic visualization. This result emphasizes the diagnostic limitations of bronchoscopy so that in peripherally situated lesions one always must consider exploration when all other diagnostic methods yield only presumptive evidence of carcinoma.

In a discussion of the operability of bronchogenic carcinoma, Gibbon and his associates [44] stressed the importance of early diagnosis, since the earlier the diagnosis the earlier treatment will be applied, and this should favorably affect the prognosis. In a series of 118 cases of carcinoma of the lung a positive diagnosis by bronchoscopic biopsy was secured in 52 (44 per cent). Additional suggestive bronchoscopic evidence was obtained in 23 (20 per cent). In addition to a routine bronchoscopy in this group, secretions also were aspirated for cytologic examination by the Papanicolaou technic. In this group a positive diagnosis of carcinoma was made in 105 cases (89 per cent). Neo-

42. Call, J. D., and Vinson, P. P.: Accumulation of Blood Simulating Primary Bronchial Cancer, Am. J. Roentgenol. **59**:227 (Feb.) 1948.

43. Ochsner, A.; DeBakey, M.; Dunlap, C. E., and Richman, I.: Primary Pulmonary Malignancy: Factors Influencing Survival, J. Thoracic Surg. **17**:573 (Oct.) 1948.

44. Gibbon, J. H., Jr.; Clerf, L. H.; Herbut, P. A., and DeTuerk, J. J.: The Diagnosis and Operability of Bronchogenic Carcinoma, J. Thoracic Surg. **17**:419 (Aug.) 1948.

plastic cells were found in 43 cases in which the results of bronchoscopic examination were completely negative. It was their opinion that examination of secretions or saline washings from the bronchus suspected as being the site of cancerous growth will increase the percentage of correct diagnoses prior to operation.

Studies of the cause of lung abscess several decades ago showed that a large number complicated operative procedures about the upper air and food passages. Brock's [45] studies in this field are interesting, for he found that bronchial carcinoma now is a common cause. In a series of 405 cases of abscess, bronchial carcinoma was the cause in 56 (13.8 per cent). In the 185 patients in this series who were more than 45 years of age, the abscesses were associated with carcinoma in 30 per cent. In the 56 cases reviewed, the abscesses showed a predilection for the left upper lobe.

BRONCHOGRAPHY IN BRONCHIECTASIS

Bronchiectasis is one of the commonest diseases of the lungs in children and is more prevalent than tuberculosis. Its onset commonly follows a protracted convalescence, from one of the common childhood diseases, particularly measles, pertussis and streptococcal or influenzal pneumonia. The problem of diagnosis is difficult, and one is dependent entirely on the use of radiopaque substances, preferably iodized oil, except in the advanced cases.

Gann [46] described a catheter technic which he employed in children in preference to bronchography with general anesthesia. One of the barbiturates is given approximately one and a half hours prior to the contemplated examination. Immediately before going to the x-ray room the patient receives atropine and morphine.

All or part of the preoperative medication may be omitted, depending on the age and condition of the patient. The child is seated on a chair facing the anesthetist. The larynx is first sprayed lightly two or three times with 0.5 per cent tetracaine hydrochloride solution. Between sprays, one side of the nose is anesthetized with use of a metal applicator moistened with 2 per cent tetracaine solution. The superior laryngeal nerves are then blocked by passing a curved applicator along the posterior pharyngeal walls and into the piriform sinuses. One then uses the laryngeal mirror to anesthetize the vocal cords and eventually can pass an applicator between the vocal cords without inciting the cough

45. Brock, R. C.: Studies in Lung Abscess: Lung Abscess and Bronchial Carcinoma, Guy's Hosp. Rep. **97**:75, 1948.

46. Gann, E. L.: Bronchography in Bronchiectasis in Children, Ann. Otol., Rhin. & Laryng. **57**:153 (March) 1948.

reflex. From 0.5 to 1 cc. of a 0.5 per cent tetracaine hydrochloride solution is now instilled into the trachea, with use of a laryngeal syringe with a curved metal cannula.

A nasal catheter is then passed through the side of the nose that has been anesthetized and will frequently enter the trachea blindly. If there is any difficulty forceps may be used through the open mouth. Immediately after the intratracheal tube is in place, and if an anesthesia solution was not previously instilled, from 0.5 to 1 cc. of 0.5 per cent tetracaine hydrochloride solution is injected through the tube into the trachea. There is no set rule as to the total amount of solution to be used; the amount required is the amount necessary to abolish the cough reflex and may be as little as 1 to 2 cc. of a 0.5 per cent solution, while as much as 4 cc. may be required by other children. In Gann's experience it was rare that a child 4 years of age or more could not, with the exercise of some patience, be intubated by this procedure. Occasionally, with smaller children and more rarely with older ones it may be necessary to restrain the child and pass the catheter through the nose into the oropharynx and then guide it into the trachea with the aid of a laryngoscope.

All the lobes of both lungs are mapped in one sitting. By posturing the patient to one side or the other the iodized oil can be made to flow into either main bronchus. After filling is completed the catheter is quickly withdrawn and the exposures are made immediately. Anteroposterior and both right and left anterior oblique views are taken routinely.

Farinas [47] described a method of bronchography in which an atomizer is used with different types of tips for introduction into the larynx, trachea and bronchi. After preliminary anesthetization with a 1 per cent tetracaine hydrochloride solution, 10 to 15 cc. of iodized oil (20 per cent) is vaporized into the tracheobronchial tree, with air pressure from 6 to 8 pounds (2.7 to 3.6 Kg.). Positioning of the patient under the fluoroscope is used to outline the desired pulmonary segments. The author stated the belief that fine details of the bronchial mucosa can be brought out by this method.

UNTOWARD EFFECTS FOLLOWING BRONCHOGRAPHY

In recording a death following bronchography, Harrill and Alsup [48] reviewed the literature and found that there were records of fatal and nonfatal reactions following the instillation of iodized oil into the

47. Farinas, P. L.: Bronchography by Atomization, Radiology **51**:491 (Oct.) 1948.

48. Harrill, J. A., and Alsup, W. B.: Death Following Bronchography, Ann. Otol., Rhin. & Laryng. **57**:1088 (Dec.) 1948.

tracheobronchial tree. In their patient, a boy aged 2 years, death occurred forty-five minutes after a bronchographic study in which iodochloral was used. Death was thought to have been due to iodine sensitivity. The authors therefore warned that in doing bronchography certain precautions should be taken to guard against respiratory embarrassment in the event of sensitivity. Unfortunately, there is no known test to predetermine sensitivity to iodized oil.

While complications during or following bronchography occasionally arise, most of them can be avoided by ascertaining if the patient is sensitive to the local anesthetic to be used and if he is not suffering from acute pulmonary disease, advanced emphysema or other illness that contraindicates this procedure.

It is generally recognized that iodized oil is retained in the lungs for many months. This condition suggested to Zavod [49] the question of whether there was any functional disturbance in the respiratory system that could be measured or if there was any immediate effect on the respiratory function while the oil still was in the bronchi. In an investigation based on a study of 50 unselected patients who had bronchograms, spirometric studies were carried out before and after the instillation of iodized oil. Zavod found that 90 per cent of the patients showed a definite loss of pulmonary function and decrease in some pulmonary volume one hour after the bronchogram. The highest loss was in the reserve air. Daily spirometric studies after bronchography revealed that the loss is recovered gradually and that a return to the level prior to the bronchographic study occurs within a minimum of five days.

ESOPHAGOLOGY

An excellent review of the progress and the present status of esophagology was presented by Holinger,[50] who pointed out that this has been dependent on and paralleled the progress in esophagoscopy. Obviously, many factors must be taken into consideration, and this includes the progress made not only in the development of armamentarium but also in anesthesia and radiologic guidance. A number of clinical conditions are discussed and the progress in the diagnosis and treatment is referred to. The greatest progress in esophagology in recent years has been in surgery of the esophagus. These advances are in part dependent on the advances made in chemotherapeutics and in anesthesia.

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49. Zavod, W. A.: Functional Pulmonary Changes Following Bronchography, Am. Rev. Tuberc. **57**:626 (June) 1948.

50. Holinger, P. H.: Progress in Esophagology, Arch. Otolaryng. **47**:119 (Feb.) 1948.

ESOPHAGEAL ATRESIA

Byron [51] believed that in all cases of congenital atresia of the esophagus preoperative tracheoscopy should be performed. In the case reported, failure to use tracheoscopy as a preoperative diagnostic measure was a serious omission. When there is failure to demonstrate air in the stomach and a tracheoscopy discloses no tracheoesophageal fistula, an extrapleural exploration seems futile, and a left transpleural esophagogastrostomy is indicated.

ESOPHAGITIS

According to Olsen,[52] esophagitis occurs more frequently than is recognized clinically. The symptoms of substernal burning, dysphagia and hematemesis are frequently attributed to other causes. In most cases esophagitis probably subsides without leaving any ill effects, but repeated episodes may lead to progressive cicatrization and may be responsible for the shortening of the esophagus that sometimes is encountered in esophageal hiatal hernia. In esophageal hiatal hernia the reflux of gastric acids into the esophagus is thought to lead to recurrent attacks of esophagitis.

HIATUS HERNIA

Two cases of esophageal hiatus hernia with inversion of the stomach were reported by Marks,[53] and in 1 case strangulation of the stomach developed with a fatal outcome. Inversion of the stomach increases the potential dangers of esophageal hiatus hernia and should be suspected if gas bubbles are seen both above and below the diaphragm in the roentgen examination.

In a study of esophageal hiatal hernia, Olsen and Harrington [54] stated that because the treatment of the short esophagus type of hernia is radically different from that of the usual hiatal hernia it is important that an accurate diagnosis be made. To achieve this necessitates careful roentgenoscopic studies and esophagoscopy.

The commonest symptom in patients with hernia of the short esophagus type is dysphagia. This condition is treated most satisfactorily by dilations performed over a previously swallowed thread. Because of the cicatricial nature of the stenosis dilation must be repeated from time to time.

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51. Byron, F. X.: Congenital Atresia of Esophagus with Hypoplasia or Agenesis of Lower Segment, Surgery **24**:841 (Nov.) 1948.

52. Olsen, A. M.: Esophagitis, Surg., Gynec. & Obst. **86**:372 (March) 1948.

53. Marks, J. H.: Esophageal Hiatus Hernia with Inversion of Stomach, Am. J. Roentgenol. **60**:63 (July) 1948.

54. Olsen, A. M., and Harrington, S. W.: Esophageal Hiatal Hernias of the Short Esophagus Type: Etiologic and Therapeutic Considerations, J. Thoracic Surg. **17**:189 (April) 1948.

Medical treatment is directed against the further development of ulceration in the esophagus. In the presence of an ulcerative esophagitis a bland type of diet, such as that used in the treatment of peptic ulcer, is desirable. The frequent use of antacid preparations will keep gastric secretions neutralized. For patients who are overweight a reduction program is imperative. Elevation of the head of the patient's bed is a valuable aid. This procedure prevents regurgitation of secretions into the esophagus during the night. A majority of these patients with short esophagus can live comfortably if they will follow the regimen outlined and report for dilation when necessary.

Acquired esophageal hiatal hernia is the commonest type of nontraumatic diaphragmatic hernia. In a review of the subject Putney [55] observed that symptoms commonly are multiple and depend on the amount of mechanical interference with the stomach, the degree of diaphragmatic impairment and the amount of increased intrathoracic pressure. The diagnosis is made by roentgen and esophagoscopic findings of a portion of stomach above the diaphragm, absence of the hiatal pinchcock action and redundancy of the esophageal mucosa.

The treatment is surgical, medical, mechanical or dietary. Antispasmodics and alkalis are helpful in relieving symptoms. Avoidance of bulky foods, fluids and thorough mastication and swallowing small amounts at a time are important. Liquids, taken during the course of a meal, aid in washing down the bolus, particularly if there is a tendency toward stagnation at the site of herniation. Constrictions about the abdomen tend to increase intra-abdominal pressure and intensify the symptoms. Postural drainage may be used to encourage the passage of foods, and patients often assume a semirecumbent position for sleeping.

The principles involved in mechanical treatment are relief of obstruction by dilation and the treatment of ulcerations by topical applications. Dilation of obstruction may be done either esophagoscopically or perorally by passing an olive-tipped bougie over a previously swallowed thread. In cases with ulceration, treatment must be performed esophagoscopically so that the ulcerated areas may receive local treatment. The use of silver nitrate, 10 per cent solution, has proved adequate.

Surgical treatment is preferable if the symptoms are progressive and should be done while the patient is in optimum operative condition. In patients who are poor operative risks, phrenic exeresis alone is useful to relieve symptoms caused by obstruction and strangulation.

In addition to the complications of achalasia and temporary stenosis of the esophagus following vagotomy, Beal [56] has added another. He

55. Putney, F. J.: Esophageal Hiatal Hernia, Ann. Otol., Rhin. & Laryng. **57**:846 (Sept.) 1948.

56. Beal, J. M.: Diaphragmatic Hernia Following Subdiaphragmatic Vagotomy, Surgery **24**:625 (Oct.) 1948.

reports a case of subdiaphragmatic vagotomy followed by a hiatus hernia of the paraesophageal type, necessitating surgical repair of the hernia.

VARICES OF ESOPHAGUS

Fatal exsanguinating hemorrhages from rupture of esophageal varices occurs in about 1 out of 4 patients suffering from Manson's schistosomiasis. In a discussion of this subject, Munoz-MacCormick [57] reported his results of treatment by the injection of 5 per cent sodium morrhuate into the varices. While many methods of therapy have been used, it is his opinion that splenectomy followed by the injection of a sclerosing solution into the varices at frequent intervals proved to be the treatment of choice. Injection of sclerosing solution at intervals of a few days until all apparent sources of bleeding have been sclerosed did not appear to suffice unless repeated at intervals of several months, since recanalization or the formation of new varices may take place with recurrence of bleeding.

ESOPHAGEAL STRICTURES

One of the great handicaps in the treatment of stricture of the esophagus is that a majority of the patients present themselves when the lumen of the esophagus is almost completely obliterated so that they are unable to swallow even saliva and are in a state of malnutrition. In a discussion of this subject, Cody [58] stated that the prime objective in treatment is to relieve the patient of his symptoms and to establish an adequate esophageal lumen. In the acute type, dilation should be started on the third day after the burn and repeated daily for three to four weeks, progressively increasing the size of the dilator.

In advanced cases gastrostomy can rarely be avoided because of the need to provide a passageway for food. One then can institute retrograde esophageal dilation. Cody recommended using the Hurst dilators as early as possible and that the patient should be taught to perform the dilation. In a report of 14 patients with esophageal stenosis, 13 gave a very satisfactory response.

While stricture of the esophagus is of common occurrence, recorded cases of pyloric obstruction associated with stricture of the esophagus following the ingestion of lye appeared to be unusual. Bolstad [59] reported

57. Munoz-MacCormick, C. E.: The Injection Treatment of Esophageal Varices Due to Manson's Schistosomiasis: Preliminary Report, Laryngoscope **58**:992 (Sept.) 1948.

58. Cody, C. C., III.: Management of Esophageal Strictures, Arch. Otolaryng. **47**:133 (Feb.) 1948.

59. Bolstad, D. S.: Pyloric Obstruction and Stricture of Esophagus Following Ingestion of Lye (Sodium Hydroxide Mixed with Sodium Carbonate), Arch. Otolaryng. **47**:180 (Feb.) 1948.

2 cases, both occurring in women who had ingested lye with suicidal intent. In each instance an apparently complete pyloric obstruction occurred within a relatively short period. In both, it was necessary to do a gastroenterostomy in addition to carrying out dilation of the esophageal stenosis.

Otte [60] presented his results in 8 cases of cicatricial stenosis of the esophagus occurring in children due to accidental swallowing of caustic soda. He emphasized that these patients invariably reported late for treatment and that one is confronted with nutritional problems as well as those attendant on dilating a greatly narrowed stricture. He expressed the belief that retrograde dilation is the best method of treatment in children since it can be carried out more readily than peroral methods.

The Salzer method is recommended as a form of treatment in patients that are seen early. If applied immediately after the accident it gives successful results in 80 to 90 per cent of cases in less than eight weeks.

A large series of cases, 136, of burns of the esophagus due to the accidental ingestion of lye, were reported by Kernodle and his associates.[61] The great majority of patients were drawn from rural areas. Exceptionally good results were reported, especially in those patients who presented themselves for immediate care. The regimen, as outlined, consisted of prompt neutralization with a weak acid followed by the emollient action of olive oil. Then, beginning on the fourth day, a soft rubber catheter (mercury filled) was passed, and this procedure was repeated daily for two weeks. The procedure was then performed every two days, then twice weekly, and the interval between procedures was increased until there was no further evidence of esophageal obstruction. Strictures occurring late after the accident were treated as needed by esophagoscopic dilation or by the dilating effects of graduated olive-tipped bougies passed over a previously swallowed string.

Although these procedures are not new, the virtue of the manner in which they are applied is attested to by the good results reported and again emphasizes the importance of starting treatment promptly in order to prevent cicatricial stenosis.

TUMORS OF THE ESOPHAGUS

Pedunculated benign tumors of the esophagus are rare, and in some cases the symptoms are mild. Beeler and his co-workers [62] reported a case of polyp of the upper end of the esophagus with symptoms of

60. Otte, J.: Cicatricial Stenosis of Esophagus, Rev. otorrinolaring. **8**:117 (June) 1948.

61. Kernodle, G. W.; Taylor, G., and Davidson, W. C.: Lye Poisoning in Children, Am. J. Dis. Child. **75**:135 (Feb.) 1948.

62. Beeler, R. C.; Collins, J. N., and Hall, M. F.: Benign Pedunculated Tumors of the Esophagus, Am. J. Roentgenol. **60**:466 (Oct.) 1948.

choking and a feeling of fulness in the neck lasting for twelve years. During a severe attack of choking, a mass was protruded beyond the mouth but did not produce obstruction to breathing; it was later swallowed. On a roentgenogram there was observed a large filling defect extending from the level of the seventh cervical vertebra down to the sixth thoracic vertebra. The tumor was removed with general anesthesia by suspension laryngoscopy with a specially constructed long spatula to expose the mouth of the esophagus. The tumor was attached by a pedicle at the upper esophageal orifice. After a clamp and ligature had been applied, it was severed at its attachment. The mass measured 8½ inches (21.6 cm.) in length and 1 inch (2.5 cm.) in diameter and on histologic section was largely fibrolipomatous in structure.

PINS IN THE BRONCHUS

Pins in the periphery of the lung are, fortunately, rare. Glass [63] reported 2 cases of common pin in the periphery of the lung, which were removed after three and two attempts respectively. The question arose as to how often it would be justifiable to repeat attempts to remove the pin with fluoroscopic assistance.

The absence of marked reaction permits of considerable delay, and it seemed reasonable to suggest that several attempts could be made before concluding that the pin was impacted and that further attempt would be futile. It is apparent that pins in the periphery cannot be visualized bronchoscopically, and the therapy is absolutely dependent on fluoroscopic visualization. Glass described his experiences with a single plane fluoroscope.

COMPLICATIONS OF FOREIGN BODIES

While the management of foreign bodies in the air and food passages often has been emphasized and appeared to have been relegated to a secondary position due to other diagnostic and therapeutic phases, it is receiving increased attention. The pulmonary complications produced by foreign body often are so serious that it is important to stress these repeatedly as etiologic agents of extensive pulmonary disease.

In an analysis of a series of 1,026 consecutive cases of foreign bodies in the air and food passages, Holinger and his associates [64] discussed many of the complications. These complications included asthma, emphysema, atelectasis, pneumothorax, bronchiectasis, pulmonary abscess and empyema. In 353 cases of bronchial foreign bodies, there were 2

63. Glass, G.: Pins in the Periphery of the Lung, J. Laryng. & Otol. **62**:715 (Dec.) 1948.

64. Holinger, P. H.; Andrews, A. H., Jr., and Anison, G. C.: Pulmonary Complications Due to Endobronchial Foreign Bodies, Illinois M. J. **93**:19 (Jan.) 1948.

fatalities (0.6 per cent). One fatality was due to a metastatic brain abscess from a bronchiectasis, and the other resulted from a number of surgical procedures carried out for multiple pulmonary abscesses secondary to lodgment of a kernel of corn in the bronchus.

The establishment of a correct diagnosis is important and in order to do this one must carefully evaluate the history. A noncontributory history, however, is misleading. One must depend on physical findings and roentgen studies, and often one must do a diagnostic bronchoscopy in order to rule out foreign body as a diagnostic possibility, particularly in the presence of bronchopulmonary findings of unknown cause.

In a review of a series of 250 consecutive cases of foreign body in the air and food passages, Norris [65] found that the most frequently encountered were bones, which constituted 28 per cent of the entire series, followed by coins, safety pins, vegetal foreign bodies and meat, in this order.

Significant delays in diagnosis occurred in 23 per cent of the cases with bone as a foreign body. In 20 per cent of the cases with coin as a foreign body and in 48 per cent of the cases of vegetal foreign body, the interval preceding diagnosis was greater than one week. In only 1 of the cases with safety pin as a foreign body was it "overlooked." Delays in diagnosis, when they occurred, were in many cases attributable to failure of the physician first consulted to recognize the possible presence of a foreign body or the need for roentgen examination.

The small esophageal speculum proved to be the most satisfactory instrument for visualization and removal of coins from the cervical esophagus of children. In the cases of safety pin in the hypopharynx, removal was usually by the "dangling" method. In 14 of the 17 cases of open safety pin in the esophagus, removal was effected by endogastric version. A rubber-sheathed ring rotation forceps, used without the esophagoscope, has at times been helpful in such cases in averting dyspnea (in infants and young children) from compression of the trachea by the esophagoscope.

The results of roentgen examination, including fluoroscopy, were reported as negative in 5 (20 per cent) of the cases of vegetal foreign body in the tracheobronchial tree. Careful physical examination proved to be of great importance, not only in the diagnosis and location of such foreign bodies but also in determining the presence of residual fragments following the first bronchoscopic removal.

Tracheotomy following bronchoscopy for vegetal foreign body was required in only 1 case (peanut shell in the trachea of a 13 month old

65. Norris, C. M.: Foreign Bodies in the Air and Food Passages: A Series of Two Hundred and Fifty Cases, Ann. Otol., Rhin. & Laryng. **57**:1049 (Dec.) 1948.

boy); in 1 other case (bean in the bronchus of an 8 month old girl) tracheotomy had been performed prior to admission.

There were 2 fatal cases in the series of 250, a mortality of 0.8 per cent. In 1 of these patients, a child of 13 months on whom tracheotomy was required following bronchoscopic removal of a fragment of peanut shell, the terminal event was massive pneumothorax secondary to mediastinal emphysema. In the other case, a man aged 47 died from hemorrhage ten days after esophagoscopic removal of a sharp double-pointed spicule of bone lodged at the level of the aortic arch, apparently as a result of pressure necrosis of the wall of the aorta.

The case of prolonged sojourn of a bronchial foreign body reported by Penta[66] again emphasized the effects of long-continued bronchial obstruction. In his case, that of a boy aged 10, there was absence of a typical history of foreign body aspiration. The roentgen findings suggested bronchopneumonia, but three days later there developed general mediastinal and subcutaneous emphysema involving the entire front and back of the chest and the fascial planes of the neck.

Roentgen studies made a few weeks later revealed obstructive emphysema of the entire left lung which was not interpreted as being due to foreign body, and the true nature of the condition was not detected until after a thoracotomy had been done to drain pus from the pleural cavity and the patient was becoming progressively worse. The foreign body proved to be the rubber sac of a fountain pen, which completely obstructed the left main bronchus. Following its removal by bronchoscopy, nine weeks after it was aspirated, the patient made a prompt and satisfactory recovery.

The aspiration of timothy grass, as reported by Carter and Welch,[67] is prone to produce a severe vegetal type of foreign body reaction in the bronchial mucosa. The consequent varying degrees of bronchial obstruction eventually resulted in pulmonary suppuration. Of the 8 cases reported, bronchiectasis developed in 5, large single abscesses in 2, and multiple abscesses in 1.

The development of pulmonary suppuration is accountable for the delay in diagnosis. In spite of a positive history of aspiration of a foreign body in 5 cases and of recurrent intermittent fever in all cases, there was a delay in diagnosis of bronchial foreign body varying in time between two and thirty-six months. The outstanding omission in the diagnostic routine was failure of making a roentgenographic study of

66. Penta, A. Q.: Unusual Pulmonary Complications Resulting from Prolonged Lodging of Nonopaque Foreign Body in Left Main Stem Bronchus, Arch. Otolaryng. **48**:233 (Aug.) 1948.

67. Carter, M. G., and Welch, K. J.: Bronchiectasis Following Aspiration of Timothy Grass: Report of Eight Cases, New England J. Med. **238**:832 (June) 1948.

the chest. It is interesting to note that in 3 cases the foreign bodies were recovered bronchoscopically.

Eventual definitive therapy in 7 cases consisted in lobectomy of the affected part; 1 case was resolved spontaneously after three years.

ESOPHAGEAL FOREIGN BODIES

The problem of loose dentures as esophageal foreign bodies was discussed by Richardson,[68] who stressed certain important points. Dentists and physicians do not appreciate the danger to the patient when he is supplied with an artificial temporary denture, particularly one made to supply upper central incisor teeth. Richardson expressed the belief that these dentures should be abandoned by men of the dental profession, since they constitute a menace to the wearer. While these dentures appear to offer a quick, pleasing and inexpensive cosmetic asset, it is not generally appreciated that the hazards are great when such a denture is lost, and instead of passing through lodges in the esophagus.

Early diagnosis of a denture lodged in the esophagus shortens the postoperative convalescence. The increasing use of radiolucent acrylic compounds for the construction of dentures makes their recognition roentgenographically very difficult. When no radiopaque pins are used to hold the tooth to the denture, a roentgen diagnosis may be missed. The history and the patient's symptoms are very important.

Richardson stated the preference for ether as the anesthetic of choice for the removal of large dentures. It provides maximum relaxation, permitting maximum working space. Without an adequate armamentarium, extractions should not be attempted. More harm than good may result from only slight manipulation of the foreign body.

The use of sulfonamide compounds and antibiotics practically does away with the necessity of immediate external incision and drainage for esophageal perforation. Not infrequently, surgical treatment is unnecessary.

In the prophylaxis of foreign bodies, particularly dentures, it is important to emphasize the risk of wearing broken dentures and loose removable bridges. The temporary dentures supplying the upper central incisor teeth is a menace, and the danger should be brought to the attention of members of the dental profession. It is Richardson's opinion that the complete upper denture should be redesigned.

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68. Richardson, J. R.: Loose Dentures as Esophageal Problems, Arch. Otolaryng. **47**:772 (June) 1948.

News and Comment

ANNOUNCEMENT

The American Board of Otolaryngology will conduct examinations on the following dates:

Oct. 3 to 6, 1950, the Palmer House, Chicago.

Jan. 8 to 11, 1951, the Hotel Biltmore, New York.

Book Reviews

Some Relations Between Vision and Audition. By J. D. Harris, Ph.D. Price, $1.50. Publication 71, American Lecture Series. Charles C Thomas, Publisher, 301-327 E. Lawrence Ave., Springfield, Ill., 1950.

This highly technical book is written in a vocabulary that will scarcely be understood by the average otologist unless he has had training in higher physics and mathematics. Yet, it appears to be authoritative, exact and comprehensive.

The subject of comparison in the functions of the eyes and ears is undoubtedly of some importance and value and has already been undertaken by Roydon-Smith ("Theories of Sight and Sound," Oxford University Press).

There may come a time when treatises of this sort will be reduced to an understandable text; until then, much that is of value cannot be utilized by all of us.

Cytologic Diagnosis of Lung Cancer. By Seymour M. Farber, M.D., Milton Rosenthal, M.D., Edwin F. Alston, M.D., Mortimer A. Benioff, M.D., and Allen K. McGrath Jr., M.D., from the University of California Medical Service and the Department of Pathology, San Francisco Hospital, and the San Francisco Department of Health. Pp. 59, with 10 plates and 60 illustrations in full color. Charles C Thomas, Publisher, 301-327 E. Lawrence Ave., Springfield, Ill., 1950.

This monograph is devoted solely to the cytologic diagnosis of pulmonary cancer and is based on the study of the various authors of 1,526 cases at different institutions. Cytologic changes of significance of various pathologic conditions which may involve the lung are graphically illustrated by ten plates, with 60 colored illustrations. The text supplements the pictures very adequately so that the interpretation of the type of cells found may be more easily recognized and identified.

Since the method of examination of sputum and bronchial washings which the authors advocate seem to have established itself along with other methods to be utilized for the diagnoses of pulmonary pathology, this book is recommended and should be read by interested pathologists and clinicians.

The contents of the book are arranged in the following chapter sequence: introduction; evolution of cytologic technic; technic; histology of the respiratory tract in normal and benign pathologic conditions; pathology of bronchogenic carcinoma; technical advantages for the study of cell detail with wet smears; identi-

fication of nonmalignant cells; cytologic criteria of malignant change; clinical material and data; clinical and pathologic results, and conclusion. Thus, it is evident that the subject matter is very adequately covered.

Theories of Hearing. By P. J. Kostelijk, M.D. Price, 5.90 guilders. Pp. 180, with illustrations. Universitaire Pers Leiden. Agents, Messrs. Martinus Nijhoff, Lange Voorhout 9,'s Gravenhage.

This book is a comprehensive review of the knowledge of the conduction of sound to the sense organ in the inner ear. The book has been limited to this phase of hearing in order to be as complete as possible. It is an excellent review and accomplishes its purpose extremely well, particularly in bringing a close correlation of the concepts from physical and biological viewpoints.

Critical reviews of most of the major experimental contributions and concepts on the conduction of sound to the inner ear are included in this publication. The structure and characteristics of the inner ear and its fluids are covered in a twenty page chapter. A brief historical survey of theories of hearing up to the middle of the nineteenth century is presented. Following these two chapters are several detailed and well correlated chapters, which include theories and experiments on the conduction of sound to the ear, frequency analysis, the hydrodynamic aspects of the inner ear, biophysics of the conduction of sound to the inner ear and the very important subject of the physical nature of the ear as a sound receiver.

All of the data are presented in a lucid manner. There are only a few diagrams, but they are clear and well described. The summary is translated into three languages, but the entire book is written in excellent English. The references include most of the important contributors in the field of hearing throughout the world. The author presents a brief but profound chapter in which he draws conclusions from material included in the book. He analyzes very complicated concepts and interprets them into very astute conclusions. The conduction of physical energy to the organ of Corti is regarded as a complicated mechanical system capable of executing forced vibrations. The biologic aspects of this stage of conduction are considered as almost negligible. The important impedance-matching function of the middle ear is clearly emphasized. The inner ear is regarded as essentially a hydrodynamic system, about which much is yet to be learned.

The book is an outstanding contribution to a field in which there are so many conflicting theories and experiments.

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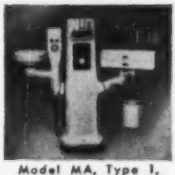

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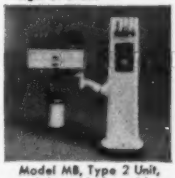

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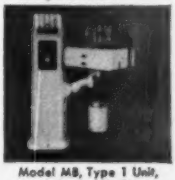

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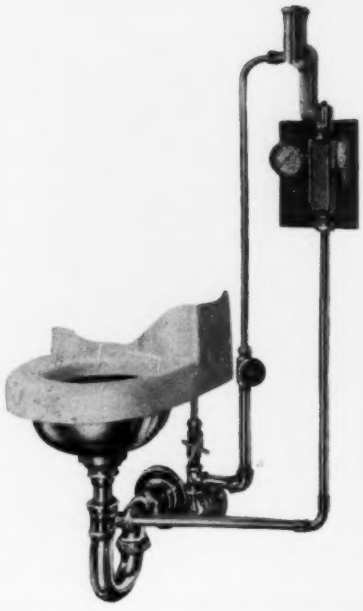

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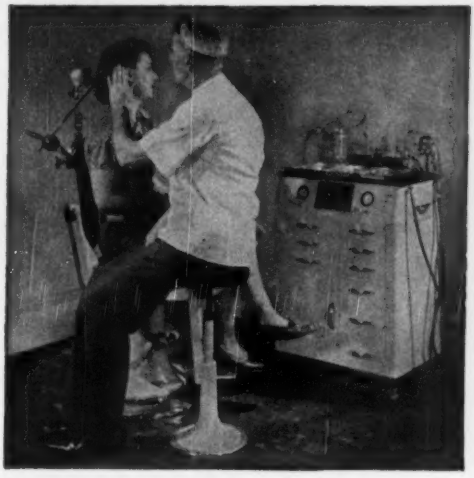

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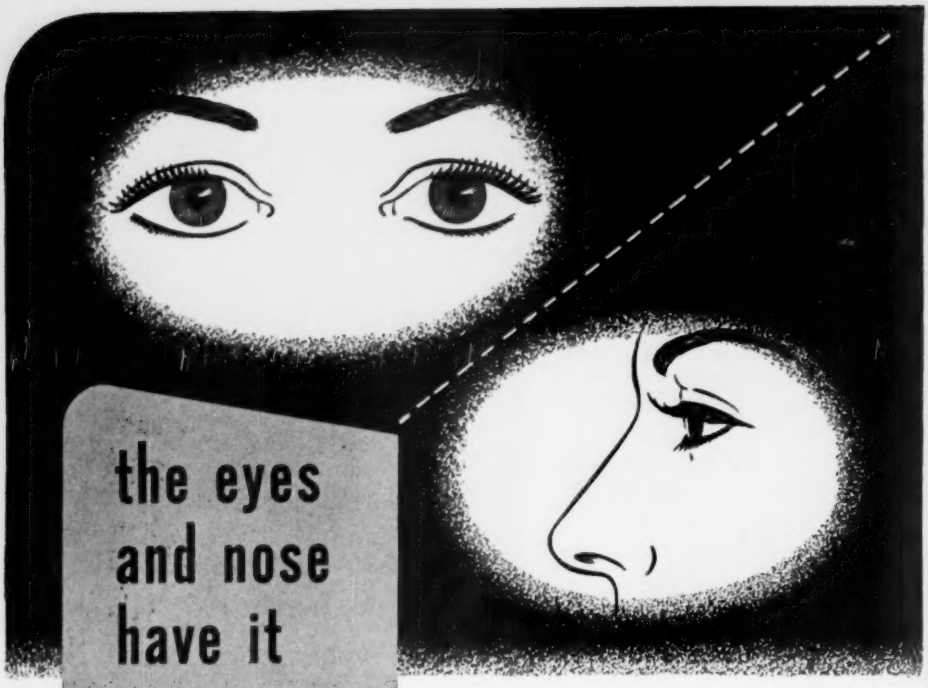

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